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WORKSHOP MANUAL FOR R510(B)

Part Number: 9789960251



# **TABLE DES MATIERES**

MANUEL D'ATELIER POUR R510(B)

Numéro de pièce: 9789960251



# **CONTENTS**

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**A-LST SYSTEM** 

**POWER TRAIN** 

**BRAKE SYSTEM** 

STEERING SYSTEM

FRONT SHOVER LOADER

**BACKHOE** 

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## OPTIONAL UNITS AND ATTACHMENTS

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# **TABLE DES MATIERES**

## UNITES FACULTATIVES ET ATTACHEMENT

## Classification

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## **Record of Revisions**

Symbol	Date	Main Revised Points & Corrective Measures	Person-in-charge
1	1991 March 31th	<ol> <li>LST charge pump flow &amp; pressure</li> <li>Steering controller &amp; flow priority valve</li> <li>Engine V2203•DI•BDW → V2203-BDW</li> </ol>	Hirakata C.E. Service Engineering Section M.Tanaka
2	1993 December	LST system pressure     Brake system	Hirakata C.E. product Support Section H.Tsurume
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## Section 1

# General

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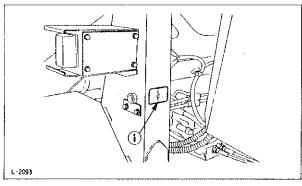
## A. Body, engine and backhoe serial numbers

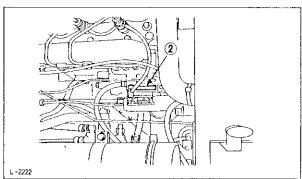
## A. Numéros de série, du corps, du moteeret de le rétroca veuse.

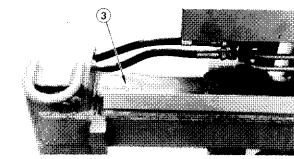
Please provide the body, engine and backhoe serial numbers shown below when inquiring about your machine or ordering parts.

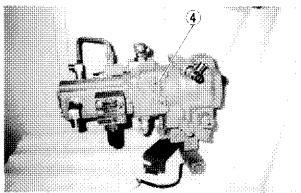
Pière de fournir les numéros de série du corps et du moteur décrits au-dessous quand vous demandez des informations ou commandez des pièces pour votre moteur.

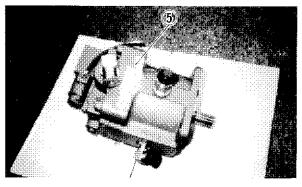
- 1 Body serial number
- 2 Engine serial number
- (3) Backhoe serial No.
- (4) LST pump No.
- (5) LST motor No.
- 6 Cylinder No.
- 1 Numéro de série du corps
- (2) Numéro de série du moteur
- 3 Numéro de série de pelle rétrocaveuse
- 4 Numéro de Pompe LST
- 5 Numéro de Moteur LST
- 6 Numéro de Cylindre

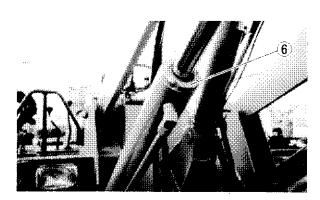






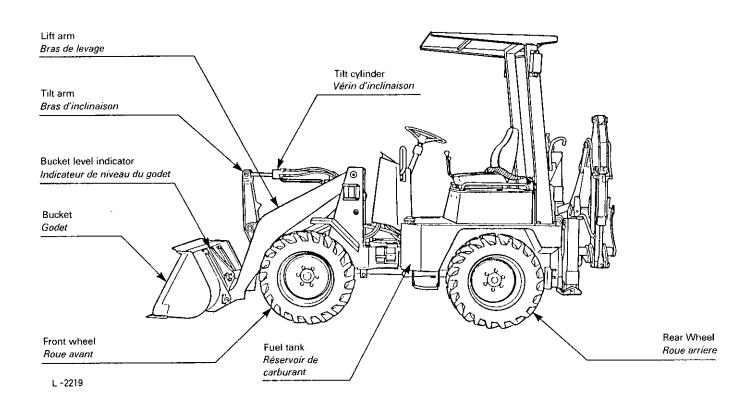


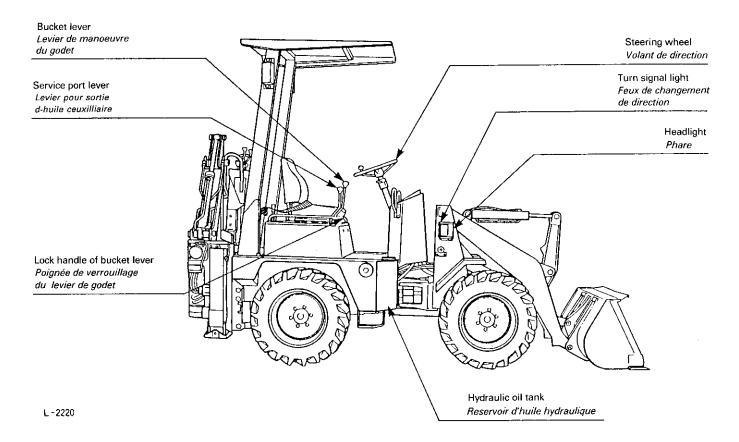


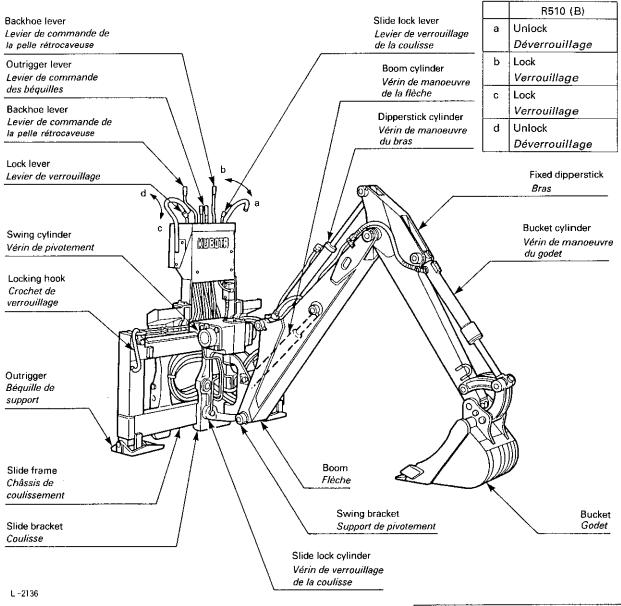


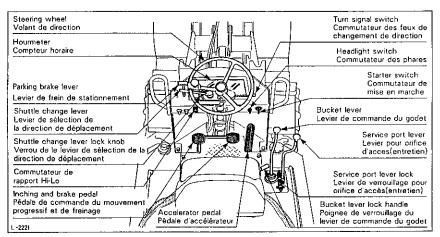
### • Part names

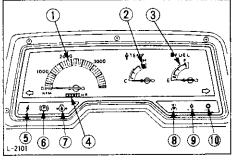
## • Nomenclature de la machine











- Engine tachometer
- Compte-tours du moteur Coolant temperature
- Température de liquide de refroidissement
- Fuel lever meter Indicateur de niveau de carburant
- Operating hour meter
- Compteur horaire de service Battery charge lamp

- Témoin de charge de batterie Parking brake warning lamp Témoin d'avertissement de frein de stationnement
- Engine oil pressure alarm lamp Témoin d'alarme de pression d'huile moteur
- (8)
- Glow lamp Temoin d'incandescence LST oil tem. alarm lamp
- Témoin d'alarme de température d'huile LST
- LST filter clogging alarm lamp
  Témoin d'alarme d'obstruction de filtre LST

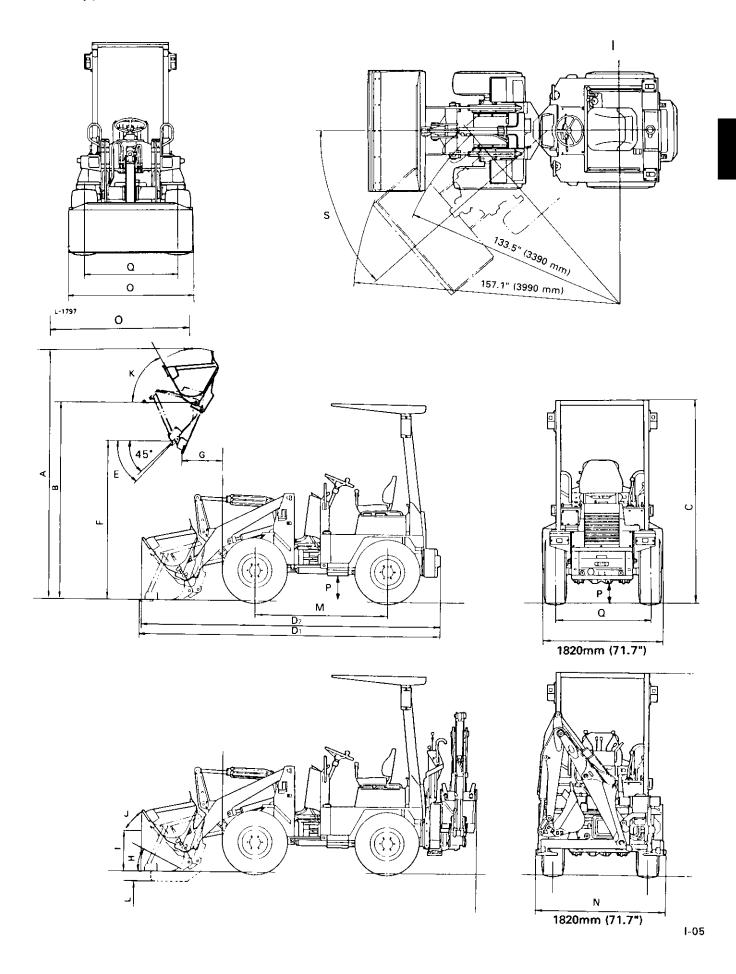
B. Machine specifications — Dimensional (SAE J732)

B. Caractéristiques de la machine — Dimensions (SAE J732)

Attachment used: KBT STD Bucket with Multi-coupler

Accessoire utilise: Benne KBT STD a multi-coupler

	ltem / Elém	ent		KBT STD Buket with Multi - coupler	
A	Overall operating height Hauteur de service hors tout		in (mm)	106.3 (2700)	
В	Height to hinge pin Hauteur jusqu'à la charnière		in (mm)	130.1 (3305)	
С	Overall height	Canopy, Rops/ Fops Capote en toile	in (mm)	106.3 (2700)	
	Hauteur hors tout	in (mm)	105.3 (2675)		
<b>D</b> 1	Overall length  Without backhoe Sans pelle rétrocaveuse		in (mm)	188.6 (4790)	
	Longueur hors tout	With Backhoe  Avec pelle rétrocaveuse	in (mm)	201.0 (5105)	
D2	Overall length Transport posture	Without backhoe Sans pelle rétrocaveuse	in (mm)	187.6 (4765)	
	Position de transport de longueur hors-tout	With backhoe Avec pelle rétrocaveuse	in (mm)	200.0 (5080)	
E	Maximum dump angle Angle de décharge maximum	degrees Degrés	50		
F	Dump height, Without teeth Hauteur de décharge, Sans dent	in (mm)	104.7 (2660)		
G	Reach, fully raised. Without teeth Portée, complètement relevé. Sans de	in (mm)	28.0 (710)		
н	Maximum rollback at ground Reprise maximum au sol	degrees Degrés	44		
ŀ	Carry position  Position de transport		in (mm)	15.0 (380)	
J	Maximum rollback at carry position Reprise maximum en position de trans	sport	degrees Degrés	46	
К	Maximum rollback, fully raised Reprise maximum, complètement rele	evé	degrees Degrés	58	
L	Digging depth Profondeur de terrassement		in (mm)	1.97 (50)	
М	Wheelbase Empattement		in (mm)	76.8 (1950)	
N	Overall width without bucket  Largeur hors tout sans godet	Without backhoe Sans pelle rétrocaveuse	in (mm)	71.7 (1820)	
		With backhoe Avec pelle rétrocaveuse	in (mm)	71.7 (1820)	
0	Bucket width Largeur de godet		in (mm)	71.7 (1820)	
Р	Ground clearance Garde au sol	2 11 11 11 11	in (mm)	13.0	(330)
a	Tread <i>Voie</i>		in (mm)	53.5 (1360)	
R	Maximum grading angle Angle de gravissement maximum	Low/High Bas/haut	degrees <i>Degrés</i>	30	0/15
s	Angle of articulation  Angle d'articulation		degrees Degrés		40



# C. Machine specifications — Operational (SAE J732) C. Caractéristiques de la machine — Service (SAE J732)

No.	ltem / Elément			Unit/ <i>Unité</i>	KBT STD Bucket with Multi-coupler	
a	Bucket capacity (Kubota STD)  Capacité de godet (STD Kubota)			cu.yd. (cu.m)	0.75 (0.57)	
b	Operating load — SAE RATING J818B  Charge de service — CARACTERISTIQUES SAE J818B			lbs. (kg)	2000 (900)	
С	Tipping load SAE rating Canopy type without B.H.  Caractéristique SAE de Type capote Sans B.H.			lbs. (kg)	4000 (1800)	
	charge de bascule	en toile	with B.H. Avec B.H.	lbs. (kg)	4630 (2100)	
		Cabin type Type cabine	without B.H. Sans B.H.	lbs. (kg)	5093 (2310)	
			with B.H., Avec B.H.	lbs. (kg)	1	
d	Tipping load Articulation angle: 0 degree	Canopy type Type capote	without B.H. Sans B.H.	lbs. (kg)	4674 (2120)	
	Charge de bascule Angle d'articulation: 0 degré	en toile	with B.H. Avec B.H.	lbs. (kg)	5445 (2470)	
		Cabin type Type cabine	without B.H. Sans B.H.	lbs. (kg)	6019 (2730)	
			with B.H. Avec B.H.	lbs. (kg)	<b>↑</b>	
е	Lift capacity to maximum heig Capacité de levage à la hauteu			lbs. (kg)	3307 (1500)	
f	Lifting capacity at ground level Capacité de levage au niveau du sol			lbs. (kg)	4321 (1960)	•
g	Breakout force Force de rupture			lbs. (kg)	7165 (3250)	
h	Raising time, No load  Durée de relevage. Sans charge			seconds secondes	5.1±0.5	
i	Lowering time, No load Durée d'abaissement,Sans ch	arge		seconds secondes	3.4±0.5	
j	Dump time, No load Durée de décharge.Sans cha	rge		seconds secondes	1.0±0.3	
k	Bucket tilt time, No load Durée d'inclinaison de godet, S	Sans charge		seconds secondes	1.1±0.3	
ı	Loader clearance circle Périmètre de sécurité de pelle	teuse		in (mm)	314.2 (7980)	
m	Tire clearance circle Périmètre de sécurité de pneu			in (mm)	266.9 (6780)	
n	Maximum traction force Force de traction maximum	Low/High <i>Bas/haut</i>		lbw (kgf)	7055 (3200) / 1984 (900)	
0	Maximum grading angle Angle de nivellement maximu	Low/High m Bas/haut		degrees degré	30/	/15
р	Oscillation angle  Angle d'oscillation			degrees degré	8	3
q	Steering turns (L/R) Virages de direction (G/D)				3.2/ 4.8	
r	Static stability Stabilité statique	Front tire off gro		degrees degré		
		Rear tire off gro Pneu arrière dé		degrees degré		
			Stroight/Articlate Proit/articulation	degrees degré	40/	38

No.	l <b>te</b> r	m / <i>Elément</i>		Unit/ <i>Unité</i>	KBT STD Bucket with Multi-coupler
s	Noise level <i>Niveau de bruit</i>	Operator's ear, Oreille de l'opér	1 **	dB (A)	10001 ~ : 88/93 20001 ~ :
		At 23 ft (7 m) A 7 m		dB (A)	10001 ~ : 20001 ~ :
t	Travel speed Vitesse de déplacement	High range Gamme haute (I	Hi)	mile/h (km/h)	10.7 (17.5)
		Low range Gamme basse (i	Lo)	mile/h (km/h)	4.3 (7.0)
u	Cycle time (V shift loading)  Durée de cycle (chargement o	le décalage V)		second seconde	31.8
٧	Working capacity (V shift loac Capacité de travail (chargeme	yd <sup>3</sup> /h (m <sup>3</sup> /h)	107.3 (75)		
w	Machine operating weight Poids d'opération de	Canopy type Type capote	without B.H. Sans B.H.	lbs. (kg)	7890 (3580)
	la machine	en toile	with B.H. Avec B.H.	lbs. (kg)	8450 (3833)
		Cabin type Type cabine	without B.H. Sans B.H.	lbs. (kg)	8345 (3785)
		1	with B.H. Avec B.H.	lbs. (kg)	8895 (4035)
Х	Axle load, Front Weight distribution	Canopy type Type capote	without B.H. Sans B.H.	lbs. (kg)	
	Charge sur essieu nominale, Avant	ır essieu en toile		lbs. (kg)	
:		Cabin type Type cabine	without B.H. Sans B.H.	lbs. (kg)	
		with B.H.  Avec B.H.  Canopy type without B.H.  Type capote Sans B.H.  en toile with B.H.  with B.H.  with B.H.		lbs. (kg)	
	Axle load, Rear Weight distribution			lbs. (kg)	
	Charge sur essieu nominale, Arrière			lbs. (kg)	
		Cabin type Type cabine	without B.H. Sans B.H.	lbs. (kg)	
			with B.H. Avec B.H.	lbs. (kg)	

# D. Machine specifications — Systematical D. Caractéristiques de la machine — Systématiques

	Machine Mode	l / Modèle de machi	R510 (B)							
	ngine oteur									
1.	Manufacturer & model Fabricant et modèle	I		V2203-DI-BDW S/ N 0~ S/N ~	V2203-BDW S/ N 0~ S/N ~					
2.	Type <i>Type</i>			Water-cooled, 4-stroke Nat. aspirated diesel Diesel 4 temps, aspiration nat., refroidi par eau						
3.	Power output Puissance	Gross-SAE J1349 Brute-SAE J1349	HP (kW)/rpm	49.3 (3	6.8)					
		JIS D1005 JIS D1005	PS (kW)/rpm	45 (33.1)						
4.	Number of cylinders Nombre de cylindre			4						
5.	Bore & stroke Alésage et course		in. (mm)	<b>3.43</b> ×3.64	4 (87x <b>9</b> 2.4)					
6.	Total displacement Cylindrée totale		in³ (cc)	134.1	(2197)					
7.	Max. torque Gros Couple maximum	ss - SAE J1349 at 26	600 rpm (Rated)	110.6	(15.3)					
8.	Fuel consumption Consommation de carb		/h.p.h. (g/ps.h) 2600 rpm (Rated)	0.36 (165)	0.42 (190)					
9.	Battery (Volt × Amps ca Batterie (Volt × capacit			12V x 56Ah	12V x 100Ah					
10	). Alternator (Volt × Am Alternateur (Volt × ca	• • • • • • • • • • • • • • • • • • • •		12V × 540W						
-	lutch & Transmission mbrayage et Boîte de v	ritesses								
1.	Type of transmission Type de boîte de vitess	es			ensing Transmission ction de charge automatique					
2.	Speed stage (F/R) Gamme de vitesse (Av.	/Ar)			and low) e et basse)					
	teering system ystème de direction									
1.	Type Type				lic power, orbitrol, center pivo ulique totale, pivot central, orbitro					
2.	Actuator Mécanisme de comma	ande		One, double : <i>Un vérin à d</i> e	acting cylinder puble action					
	raking system ystème de freinage									
1.	. Type of service brake Type de frein de servic	re			-adjusting wet disk brake tant hermétiquement scellé					
2.	Service brake capacit Capacité du frein de			16.4	(5m) >					
3.	Type of parking brake Type de frein de statio			_	ve brake négatif					
4.	Parking brake capacity Capacitédu frein de s	,		15 de	egree					
. Ti	ires Ineus									
1.	. Туре <i>Туре</i>				eless re (Tubeless)					
2.	Size, Air pressure Taille, Pression d'air				3 psi (2.2 kgf/ cm <sup>2</sup> )					

Suspension system Système de suspension		
1. Type <i>Type</i>		Frame oscillation Oscillation du châssis
Oscillation angle     Angle d'oscillation	degrees degrés	8
Hydraulic system Système hydraulique		
Type of control valve     Type de soupape de commande		Closed center Centrale, fermée
2. Type of pump Type de pompe		Gear pump Pompe à engrenages
3. Pump capacity (Main), GPM (L/mir (Steering, loader, Backhoe) Capacité de pompe (principale), GPM (direction, pelleteuse, pelle rétrocave	M (L/min)	1.40 in <sup>2</sup> (22.9 cc/rev) x 2600 15.7 GPH (59.54 l /min)
System main relief valve set pressure at bench	Loader & backhoe Pelleteuse et pelle rétrocaveuse	2490 ± 40 psi (175 ±3 kgf/cm²)
Pression de réglage du clapet de décompression principal du système sur banc d-essai	Steering Direction	2490 ± 40 psi (175 ±3 kgf/cm²)

# Front shovel bucket (SAE J742) Godet avant (SAE J742)

- KBT type
- Type KBT

Code No.	Width	Capacity Capacité SAE heaped Mise en tas SAE	Weight	Application
No. de code	<i>Largeur</i>		<i>Poids</i>	<i>Utilisation</i>
68891-7731-0	71.65 in (1820 mm)	0.75 yd³ (0.57 m³)	442 ibs (200.5 kg)	Standard

## Backhoe bucket Godet pelle rétrocaveuse

- KBT type
- Type KBT

Code No.	Width		Capacity Capacit	é	Weight	Application		
No. de code	Largeur	Struck C.E.C.E. heaped  Arasement Mise en tas C.E.C.E		SAE heaped Mise en tas SAE	Poids	Utilisation		
68741-66815	14.17 in (360 mm)	0.052 yd <sup>3</sup> (0.04 m <sup>3</sup> )			99.2 lbs. (45 kg)	R510 Narrow R510 Etroit		
68741-66826	17.72 in (450 mm)	0.065 yd <sup>3</sup> (0.05 m <sup>3</sup> )	0.08 yd <sup>3</sup> (0.058 m <sup>3</sup> )	0.09 yd <sup>3</sup> (0.07 m <sup>3</sup> )	110.2 lbs. (50 kg)	R510 STD		

Counter weight

STD: 1102 lbs (500 kgf), Optional: 1653lbs (750 kgf)

Contrepoids

Standard: 1102 lbs (500kgf), en option: 1653 lbs (750 kgf)s

## E. Quantity table of water and oil Tableau de la quantité d'eau et d'huile

- Select the grade by referring to the table.
- Choisir la classe d'apprès le tableau.

Replenish place Emplacement de L' approvisionnement	Sorte de d	oil and water carburant, s, eau	Capacity Capacité USgal. (1) R510 (B)	Vicosity No. classified by temperature  Numéros de viscosité classifiés par températures			
Fuel tank <i>Réservoir à carburant</i>		el fuel diesel	15.9 (60)	F:11.4us gal (43 Å)  Plein: 11.4 usgal (43 Å)  E:2.25 us gal (8.5 Å)  Vide: 2.25 usgal (8.5 Å)			
Engine oil pan	Engi	ne oil	1.59	Gauge center			
Cuvette-carter à huile du moteur	Huile	Huile moteur		Centre de la jauge			
Front axle differential case	Factor at	6	2.91				
Carter d'engrenages différentiels de l'essieu avant	Engine oil Huile moteur Huile engrenage  Engine oil Huile moteur Huile engrenage		(11.0)	In Hirakata Factory, Engine oil is filled to S/N 10001 ~ S/N 20099, from S/N 20100, gear oil is used in all wheel loader model's differentials.			
Rear axle differential case Carter d'engrenages différentiels de l'essieu arrière			3.00 (11.3)	When LSD is installed, gear oil M80B or equivalent should be used.			
Hydraulic system (without backhoe) Circuit hydraulique (Sans pelle rétrocaveuse)			15.85 (60)				
Hydraulic system (with Backhoe)	Engi	ne oil	17.2	Refer to recommended oils			
Circuit hydraulique (Dvec rétrocaueuse)	Huile	moteur	(65)	Se référer au tableau d'huile et de graisse de lubrication recommandées.			
Hydraulic oil tank  Reservoir d'huile hydraulique			12.95 (49)				
Brake fluid cup	Hydra	aulic oil	0.10	Hydraulic oil ISO VG 32			
Circuit de fluide du frein	Huile hy	rdraulique	(0.4)	Huile hydraulique ISO VG 32			
Grease nipple  Bout de graissage	1	Grease Graisse Water eau					
Radiator Radiateur							
Reserve tank (Réservoir)	Water	eau	0.26 (1.0)				

Note: New machine delivery condition from factory.

Fuel: No. 1-D (ASTM, D975)
Water: Includes anti-freeze of 55%

Engine oil: Kubota genuine oil, SAE 10W30

Note: Condition de livraison de machine neuve en sortie d'usine.

Carburant: No. 1-D (ASTM, D975) Eau: Contenant 55% d'antigel

Huile moteur: huile d'origine Kubota SAE10W30

# F. Routine Check Chart Points de Vérification Courante

				Į.
Ö	Check Points		Points de vérification	-
<del>-</del>	Parts that has trouble during previous use: check	Pièces ayant provoqui	Pièces ayant provoqué un trouble au cours de l'opération	
7	Check cooling water quantity in radiator and replenish as necessary.	Quantité d'eau de refroidisse l'alimentation, si nécessaire.	Quantité d'eau de refroidissement dans le radiateur et procéder à falimentation, si nécessaire.	
ကြ	⊕ ₽₽	Quantité de carburant et	Vérifier le niveau d'hulle moteur, et procéder à l'alimentation, si nécessaire.	-
	replenish as a Check operating oil level meter and replanish as necessary necessary.	verifier (2)	Vérifier le niveau d'huile moteur, et procéder à l'alimentation, si nécessaire.	8
	3 Check fuel level meter and refuel as necessary.	<u></u>	Vérifier le niveau d'huile moteur, et procéder à l'alimentation, si nécessaire.	
	Brake fluid cup.	<u>•</u>	Vérifier et approvisionnement en huile de la cuvette à fluide du frein.	
4	Greasing	Graissage	Axe de flèche de chargeur	
		©		
		<b>⊕</b>	Goupille de licuison du godet	ń
		<u>•</u>		
		·		
	(6) Lift cylinder rod pin.	<u>96</u>	Goupille de bielle du cylindre de levage Goupille de partie inférieure de cylindre de levage	
2	Universal joint: grease	Joint universal; graisse	0	
ဖြ	Center pin: grease	Goupille Du centre: graisse	isse	m
7	Articulate shaft: grease	Arbre d'articulation: graisse	aisse	_
ω	Steering cylinder pin. replenish	Goupille de cylindre de direction: procéder	e direction: procéder	-
0	Check inflation and wear or damage to tires check for loosened holts	Vérifier le gonflage l'u	Vérifier le gonflage l'usure et l'état des pneus,	
] [		Vérifier le serrage des boulons	ponlons	
2	+	Treillis de radiateur		
=	$\rightarrow$	Vérifier du levier du f	Vérifier du levier du frein de stationnement.	က်
[7		Vérifier le pédale de frein	ein	
7	÷	Verifier le fonctionne	Verifier le fonctionnement du volant de direction	
4	Check bolts and nuts for tightness, retighten as necessary.	Vérifier l'état de serra	Vérifier l'état de serrage des boulons et écrous, les resserrer, si nécessaire.	
12	Check for cable breakage, short circuit, or terminal looseness.	Rechercher toute pré de bornes	Rechercher toute présence de: interruption de câble, court-circuit, desserrage de bornes	
10	Stain, damage of number plate or SMV emblem	Saleté ou endommag	Saleté ou endommagements de la plaque de numéro: vérification	IL.
17	Check the lamps and meters.	Vérifier des lampes et des compteurs.	des compteurs.	<u>ო</u>
8	Testing the horn.	Essai de l'avertiseur sonore.	onbre	
19	Oil and water leakage	Fuite d'huile ou d'eau		
20	_	Graissage	Carter de pivot	
	(Backhoe) (2) Swing bracket 2	. 1	Ferrure de pivotement	
	(3) Swing bracket	(6)	Ferrure de pivotment	
		<u>**</u>		4
		<u>.</u>	Goupille inférieure du vérin de la flèche	
	Dipperstick cylinder bottom pin	9	Goupille inférieure du vèrin	
	(2) Boom cylinder rod pin	$\overline{U}$	Goupille de la tige du vérin de la fléche	
		8	Goupille de la tige du vérin du bras	
		<u> </u>		
		<u>ā</u>		רַ
		= :		
		2- 0		
	(a) Bucket link pin	#13 T	couplile de la tige du verin du godet	
č	Packet link pin		14. coupille de la tige du verin du godet	
[2]	Greasing the sliding section of the slide frame	Section coulissante	Section coulissante du châssis de coulissement	

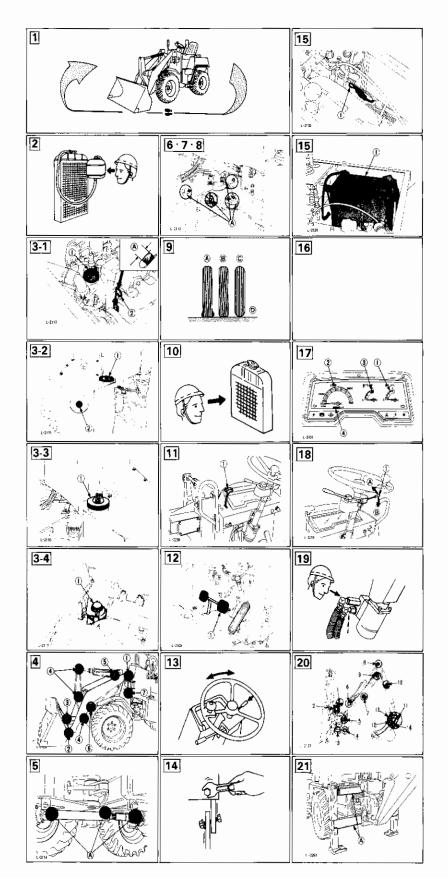
Points de vérification			15
ouble au cours de l'opération		4	
ement dans le radiateur et procéder à			
er le niveau d'huile moteur, et procéder à lentation, si nécessaire.			
ier le niveau d'huile moteur, et procéder à			
ier le niveau d'huile moteur, et procéder à nentation, si nécessaire.		A.	
ler et approvisionnement en huile de la cuvette à et du frein.	5	ร.	
de flèche de chargeur		N-se	3
du godet			
ille de licuison du godet		Q.	16
olle de martie inférieure de mailes d'inclinaises		<u> </u>	
sille de bielle du cylindre de levage		. 6	
oille de partie inférieure de cylindre de levage	G / P		
	3-2		17
			(A)
ction: procéder			
et l'état des pneus,	1		- To
	2	#/	
stationnement.	3-3	18	118
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s boulons et écrous, les resserrer, si nécessaire.		Z	
de: interruption de câble, court-circuit, desserrage		8-	
s de la plague de numéro vérification	1		
comptents.	3-4		[1] (
er de pivot			
ure de pivotement	₩ Đ	17 1.0 W.	
pille de montage de la fléche	4		20
pille inférieure du vêrin de la flèche			5
pille inférieure du vèrin		5	
pille de la tige du vérin de la fléche			
pille de la tige du vérin du bras			
orite de montage du bras			
pille inferieure du verin du godet		()	
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pille de la tige du vérin du godet			第一个
pille de la tige du vérin du godet			
issis de coulissement	The state of the s		<b>5</b>

## F. Routine Check Chart

## Points de Vérification Courante

No.		Check Points			Points de vérification					
1	Parts that has trou	ble during previous use: check		Pièces ayant provoqué un trouble au cours de l'opération Quantité d'eau de refroidissement dans le radiateur et pro						
2	Check cooling wat	er quantity in radiator and replenish as necessary.		Quantité d'eau de l'alimentation, si n						
3	Check fuel and oil quantity and	① Check engine oil level meter and replanish as necessary.		Quantité de carburant et	Vérifier le niveau d'huile moteur, et pro l'alimentation, si nécessaire.					
	replenish as necessary	<ol> <li>Check operating oil level meter and replanish as necessary.</li> </ol>		d'huile a vérifier	Vérifier le niveau d'huile moteur, et pro l'alimentation, si nécessaire.					
i		3 Check fuel level meter and refuel as necessary.			Vérifier le niveau d'huile moteur, et pro l'alimentation, si nécessaire.					
		Brake fluid cup.			Vérifier et approvisionnement en huillfluide du frein.					
4	Greasing	Shovel frame attachment pin.		Graissage	Axe de flèche de chargeur					
		Bucket attachment pin.			② Axe du godet					
		3 Bucket link pin.		1	3 Goupille de licuison du godet					
		④ Tilt link pin.		-	Goupille de maillon d'inclinaison					
		(5) Tilt cylinder bottom pin.		-	Goupille de partie inférieure de mailo					
		Lift cylinder rod pin.		1	6 Goupille de bielle du cylindre de levag					
		① Lift cylinder bottom pin.			(7) Goupille de partie inférieure de cylind					
5	Universal joint: gre			Joint universal: graisse						
6	Center pin: grease			Goupille Du centre	graisse					
7	Articulate shaft: gr	rease		Arbre d'articulation	: graisse					
8	Steering cylinder p	oin: replenish	•	Goupille de cylinde	re de direction: procéder					
9	Check inflation an	d wear or damage to tires, check for loosened bolts.		Vérifier le gonflage l'usure et l'état des pneus, Vérifier le serrage des boulons						
10	Check radiator fine	s for clogging.		Treillis de radiateur						
11	Check the parking	brake lever.		Vérifier du levier du frein de stationnement.						
12	Check the brake pe	edal.		Vérifier le pédale d	de frein					
13	Check function of	steering wheel.		Vérifier le fonctionnement du volant de direction						
14	Check bolts and no	uts for tightness, retighten as necessary.		Vérifier l'état de se	errage des boulons et écrous, les resserrer					
15	Check for cable bro	eakage, short circuit, or terminal looseness.		Rechercher toute de bornes	echercher toute présence de: interruption de câble, court-c					
16	Stain, damage of r	number plate or SMV emblem		Saleté ou endomn	nagements de la plaque de numéro: vérific					
17	Check the lamps a	nd meters.		Vérifier des lampe	es et des compteurs.					
18	Testing the horn.			Essai de l'avertise	ur sonore.					
19	Oil and water leak	age		Fuite d'huile ou d'	eau					
[20]	Greasing	① Swing case	1	Graissage	① Carter de pivot					
	(Backhoe)	② Swing bracket	2	Rétroceveuse	2 Ferrure de pivotement					
		③ Swing bracket	1		3 Ferrure de pivotment					
		Boom mounting pin	1		Goupille de montage de la fléche					
		Boom cylinder bottom pin	1		5 Goupille inférieure du vérin de la flèc					
		Dipperstick cylinder bottom pin	1		6 Goupille inférieure du vérin					
		① Boom cylinder rod pin	1		Goupille de la tige du vérin de la fléch					
		Dipperstick cylinder rod pin	1		8 Goupille de la tige du vérin du bras					
		Dipperstick mounting pin	1		Goupille de montage du bras					
		10 Bucket cylinder bottom pin	1		10 Goupille inférieure du vérin du gode					
		① Bucket cylinder rod pin	1		11. Goupille de la tige du vérin du godet					
		1 Bucket mounting pin	1		12 Goupille de la tige du vérin du godet					
		(3) Bucket link pin	1		13 Goupille de la tige du vérin du godet					
		Bucket link pin	1		14. Goupille de la tige du vérin du godet					
21	Greasing the slidir	ng section of the slide frame	2	Section coulissar	nte du châssis de coulissement					

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G. Periodic Check and Maintenance Chart Tableau d'entretien et de verification periodique

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Un ans que achant  Deux ans ajerés l'achat			ļ				ļ ! :	_	l 1						0	- 5				Replace Remplacement
Tours years from buying	_			<u> </u>			İ	 			<u> </u> 		0	mne)			-		0	
Maintenance every 1000 hrs foutes les 1000 heures Maintenance every 2000 hrs	İ									<u> </u>   		! 	<u> </u>	ps & automne,	<u> </u>			<del></del>		Replace for the first time Remplacement à effectuer pour la première fois
Maintenance every 500 hrs Toutes les 500 heures					0	0			-		!	D		an (printemps						Replace for the first time Remplacement a effectur pour la première fois
Maintenance every 250 hrs Toutes les 250 heures								<u>:</u>						Deux fois par				0		*□: Rep <i>Ren</i> pou
Maintenance every 200 hrs Joutes les 200 heures	<u> </u>	-		0			0								0					léter
Maintenance every 100 hrs Toutes les 100 heures		 <del> </del>										-		(spring and autum)	<u> </u>					Check and replenish Vérificetion et compléter
Maintenance every 50 hrs	0	0					<u> </u>	0						a year (sp	L	-				Check and replenish Vérification et com
esnuer en COS Isai an bout des 500 premières senuer			'		Ċ	Ģ			₽	Ģ	Ģ			Twice						ö
		<u>.</u>																<u></u>		first time
First 35 hrs Au bout des 35 premières	1		₽				ge ge			eli	g		eur	! 				sno.	es.	an for the mplacemen are fois
Inspection interval (froumeter)	Contrôle niveau d'électrolyte de la batterie.	Vidange du réservoir à carburant.	Vidange de l'huite moteur.	Remplacement de la cartouche de filtre à huile.	Vidange, changer et Ajouter de l'huile du boîtier du defférentiel d'essieu avant.	Vidanga, changer et Ajouter de l'huile du boîtier du defférentiel de pont arrière.	Contrôl et réglage de la tension de la courrole de ventilateur.	Nettoyer et contrôler l'élément de filtre à air.	Vidange de l'huite du réservoir hydraulique.	Remplacer l'élément de filtre d'huile hydraulique.	Remplacement du filtre d'aspiration d'huile hydraulique.	Remplacement de la cartouche de filtre à carburant.	Vèrifier le démarreur, l'alternceteur	Remplacement de l'eau de refroidissement.	Vérifier et changer les durites de radiateur et les colliers qui sort desserer.	Remplacer tuyau à essence.	Remplacer durite caout chouc du système hydraulique.	Vérifier et reserrer moyeux et écrous de roues après avoir change les pncees.	Vérifier le aâbiage électrique pour dommage et connexion desserrées.	C: Check end clean for the first time Nettoyer et remplacement pour la première fois
Item Pièce	Check battery liquid level.	Drain of the fuel tank	Change engine oil	Replace engine oil filter	Change, check and replenish oil in front axle differential case.	Change, check and replenish oil in rear axle differential case,	Check for fan belt tension and adjust as necessary.	Clean and check air cleaner element, and change if necessary.	Change operating oil.	Change LST oil filter element.	Clean and change hydraulic oil suction filter.	Change fuel filter cartridge	Check alternator, starter motor.	Change cooling water,	Check and change radiator hose and loosen band	Change fuel pipe		Check and retighten the wheel bolts in the first 100hrs, after exchanging tires.	Check the damage of electrical circuit and the looseness of the coupler.	
oʻ Z	E	7	(M)	4	[5]	9		@	[6]	10	-	12	<u>~</u>	[1]	12	16	17	8	[1]	

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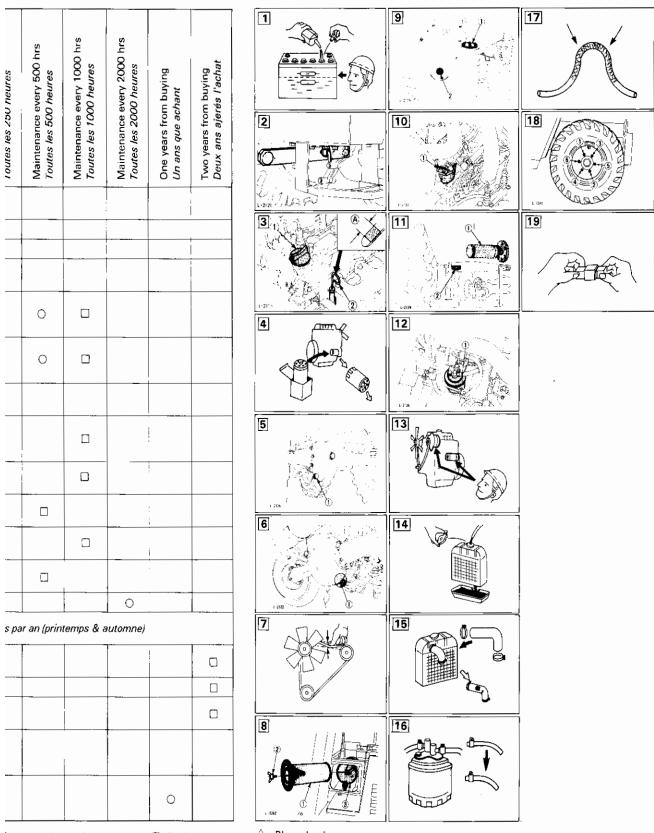
# G. Periodic Check and Maintenance Chart Tableau d'entretien et de verification periodique

No.	Item Pièce	Inspection interval (hourmeter) Interval d'inspection (Chronométre)	First 35 hrs Au bout des 35 premières heures	First 100 hrs Au bout des 100 premières heures	First 500 hrs Au bout des 500 premières heures	Maintenance everγ 50 hrs Toutes les 50 heures	Maintenance every 100 hrs Toutes les 100 heures	Maintenance every 200 hrs Toutes les 200 heures	Maintenance every 250 hrs Toutes les 250 heures
1	Check battery liquid level.	Contrôle niveau d'électrolyte de la batterie.			, ,	0			
2	Drain of the fuel tank	Vidange du réservoir à carburant.				0			
[3]	Change engine oil	Vidange de l'huile moteur.	•□				0	_	
4	Replace engine oil filter	Remplacement de la cartouche de filtre à huile.	•0						
5	Change, check and replenish oil in front axle differential case.	Vidange, changer et Ajouter de l'huile du boîtier du defférentiel d'essieu avant.			•				
6	Change, check and replenish oil in rear axle differential case.	Vidange, changer et Ajouter de l'huile du boîtier du defférentiel de pont arrière.			ū				
7	Check for fan belt tension and adjust as necessary.	Contrôl et réglage de la tension de la courroie de ventilateur.						0	
8	Clean and check air cleaner element, and change if necessary.	Nettoyer et contrôler l'élément de filtre à air.				0		Δ	
9	Change operating oil.	Vidange de l'huile du réservoir hydraulique.			***				
10	Change LST oil filter element.	Remplacer l'élément de filtre d'huile hydraulique.	7.5		•0				
11	Clean and change hydraulic oil suction filter.	Remplacement du filtre d'aspiration d'huile hydraulique.			•□				
12	Change fuel filter cartridge	Remplacement de la cartouche de filtre à carburant.			***				
13	Check alternator, starter motor.	Vèrifier le démarreur, l'alternceteur							
14	Change cooling water.	Remplacement de l'eau de refroidissement.			Twice a	year (spr	ing and au	itum) De	ux fois par a
15	Check and change radiator hose and loosen band	Vérifier et changer les durites de radiateur et les colliers qui sort desserer.						0	
16	Change fuel pipe	Remplacer tuyau à essence.							
17	Change rubber hose in hydraulic system	Remplacer durite caout chouc du système hydraulique.		: 					
18	Check and retighten the wheel bolts in the first 100hrs. after exchanging tires.	Vérifier et reserrer moyeux et écrous de roues après avoir change les pncees.		•0					0
19	Check the damage of electrical circuit and the looseness of the coupler.	Vérifier le aâblage électrique pour dommage et connexion desserrées.							

<sup>\*</sup>O: Check and clean for the first time Nettoyer et remplacement pour la première fois

O: Check and replenish Vérification et compléter

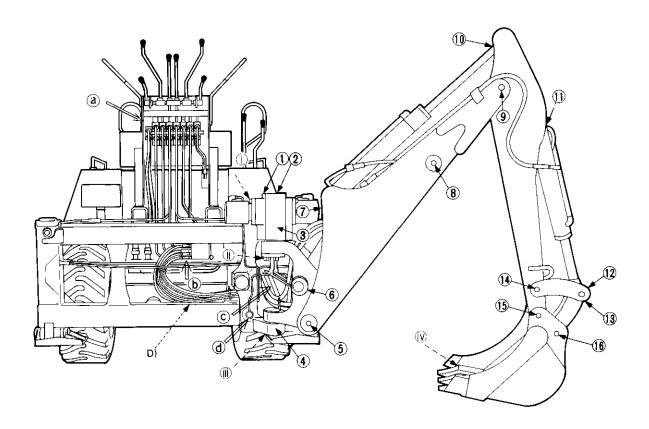
<sup>\*□:</sup> Repl Rem pour



l: Replace for the first time Remplacement à effectuer pour la première fois

☐: Replace Remplacement △ : Blow clearing Nettoyage avec de l'air comprimé

## H. Backhoe Routine Maintenance Entretien courant de la rétrocaveuse



## Routine maintenance items are as follows.

- A) Apply grease - $11 \sim 16$  indicate the greasing points.
- B) Check oil leakage.
  - a Control valve

  - b Piping block Piping block
  - d Lock cylinder
- C) Check bolts and nuts looseness.
  - (1) Swing cylinder
  - (II) Spline boss
  - (iii) Bearing nut
  - W Bucket tooth
- D) Check sliding hoses condition. -----

## Les organes pour un entretien courant sont les suivantes.

- - (1 ~16 indiquent les points de grais-
- B) Vérification de fuites d'huile :
  - a Soupape de commande
  - b Bloc des tuyauteries
  - © Bloc des tuyauteries
  - d Vérin de verrouillage
- C) Vérification du desserrage des boulons et des écrous ----
- :I) Vérin de rotation
- (II) Nervure du pivot
- Ecrou d'appui du roulement
- (iv) Dents du godet
- D) Vérification de la condition des durites de coulissement ..... >

## I. Recommended oils, fuel, grease and adhesives Huiles, graisse et adhésif recommandés

	Coverage Application	Viscosity grade Indice de viscosité	Shell	Mobil	Exxon	MIL standard Normes MIL	
Engine oil Huile moteur	Winter time or for low temperature area	SAE 10W	Shell Rotella T 10W Shell Rimula 10W	Mobil Delvac 1310	XD-3 10W XD-3 Extra 10W		
	En hiver, ou dans les régions à basse température	SAE 20W	Shell rotella T20W-20 Shell Rimula 20W-20	Mobil Delvac 1320	XD-3 20W-20 XD-3 Extra 20W-20		
	Summer timer or for high temperature area	SAE 30	Shell Rotella T30 Shell Rimula 30	Mobil Delvac 1330	XD-3 30 DX-3 Extra 30	MIL-L-2104C	
	En éte ou dans les régions à temperature élevée	SAE 40	Shell rotella T40 Shell Rimula 40	Mobil Delvac 1340	XD-3 40 XD-3 Extra 40	MIL-L-2104D	
		SAE 50	Shell Rimula 50	Mobile Delvac 1350			
	For all season Pour toutes les saisons	Multi- type	Shell rotella T15W		XD-3 15W-40 XD-3 Extra 15W-40		
	Grease, Graisse		Shell ALVANIA EP2	Mobilux EP2	BEACON Q2	_	
Fuel <i>Carburant</i>	Winter time or low temperature area En niver, ou dans les régions à basse température		No. 1-D (ASTM, D975) grade diesel fuel Huile légère no 1-D (ASTM, D975)				
	All season Pour toutes les saisons		No. 2-D (ASTM, D975) grade diesel fuel Huile légère no 2-D (ASTM, D975)				

#### [Remarks]

 Engine oil should be MIL-L-2104B/2104C or have properties of API classification CC/CD grade.

#### [Remarques]

 Pour le moteur, il faut de l'huile MIL-1-2104B/2104C ou une huile ayant les properiétés de la classe API, grade CC/CD.

It cannot be guaranteed against any problem caused by use of fuel and lubrication oil and grease that are not specified.

Il est impossible d'offrir une garantie en cas de dégâts occasionnés par l'emploi de carburant, de lubrifiant ou de graisse qui ne correspondraient pas aux spécifications données ci-dessus.

### Adhesive brands

 Refer to the table below in using adhesives. (Japan 1985)

Classification  Items  Conditions		Liquid packi	ngs	Screw-locking agents	Adhesives	
		<ul> <li>Metal to metal sealed surface</li> <li>Asbesto packing sealed surface</li> <li>surface</li> </ul> Sealing surfaces of asbestos packings		To prevent screw loosening	For joining synthetic rubber	
Location	n	Reduction gear and case Tank and cover		Bolts and nuts	Rubber/cushion	
	Product No.	Three Bond No. 2 (#1102, Yellow)	Three Bond No. 4 (#1104, Gray)	Locktight 271 or 262	Locktight 420	
Brand	Properties	Non-dry	Semi-dry, visco-elasticity	Highly Strong	Instantaneous bonding	
	Manufacturer	Three Bond		Japan Lock tight		

# Marques d'adhésifs

• Pour l'emploi d'adhésifs, se référer au tableau ci-dessous: (Japon 1985)

Classement Articles		Joints liqu	iides	Buteurs	Adhésifs	
Conditions		<ul> <li>Surfaces étaches (métal contre métal)</li> <li>Surfaces étanches (garnitures amiante)</li> </ul>	Surfaces étanches des garnitures d'amiante	Pour empécher les vis de se desserrer	Pour joindre les caoutchoucs synthétiques	
Emplace	ements	Engrenage démultiplicateur et boîtier	Réservoir et couvercle	Boulons et écrous	Caoutchoucs et coussins	
	Produit No	"Three Bond No. 2 (@1102, jaune)	"Three Bond No. 4 (@1104, gris)	Locktight 271 ou 262	Locktight 420	
Marque	Propiétés	Non-sec	Semi-sec, visco-élasticité	Grande robustesse	Connexion instantanée	
	Fabricant	Three Bo	ond	Japan Locktight		

# J. Tightness torque I. Coupie de serrage et adhésifs

# (1) Piping screw Vis du tuyau

Thread size (piping screw)	Tightness torque Couple de serrage	1	Wrench size (reference)	Remarks Remarques	
Cote du pas (vis du tuyau)	Union nut section Ecrou d'accouplement	Taper thread section  Pas du tilet	Dimension de la clé (référence)		
1/8"	7.8 ~ 11.8 N.m 0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 ft-lbf	14.71 ~ 19.61 N.m 1.5 ~ 20 kgf.m, 10.85 ~ 14.47 ft.lbf	0.67 in * 17 mm		
1/4"	24.5 ~ 29.4 2.5 ~ 3.0, 18.1 ~ 21.7	36.3 ~ 44.1 3.7 ~ 4.5, 26.8 ~ 32.5	0.75 in * 19 mm		
3/8"	49.0 ~ 53.9 5.0 ~ 5.5, 36.2 ~ 39.8	39.2 ~ 49.0 4.0 ~ 5.0, 28.9 ~ 36.2	0.87 in * 22 mm		
1/2"	58.8 ~ 63.7 6.0 ~ 6.5, 43.4 ~ 47.0	49.0 ~ 68.6 5.0 ~ 7.0, 36.2 ~ 50.6	1.06 in * 27 mm		
3/4"	117.7 ~ 127.5 12.0 ~ 13.0, 86.8 ~ 94.0	127.5 ~ 147.1 13.0 ~ 15.0, 94.0 ~ 108.5	1.42 in * 36 mm		
1"	137.3 ~ 147.1 14.0 ~ 15.0, 101.3 ~ 108.5	147.1 ~ 166.7 15.0 ~ 17.0, 108.5 ~ 123.0	1.61 in * 41 mm		

(Note) \* Wrench sizes may differ dipending on the manufacturers and thread diameters. (Note) \* La dimension des clés peut varier suivant les fabricants et le diamètre du pas.

### (2) Joint bodies Corps du joint

Thread size (piping screw)	Tightness torque Couple de serrage	N.m kgf.m, ft.lbf	Wrench size (reference) Dimension de la clé (référence)		Remarks Remarques Steel pipe (O.D.) Conduit d'acier (D.E.)	
Dimension du tilet (vis du tuyau)	(tapered thread) PT (filet conique)	PS (straight thread) PF (filet droit)				
1/8"	19.6 ~ 29.4 N.m 2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7 ft.lbf		*	0.67 in 17 mm		0.31 in 8 mm
1/4"	36.3 ~ 44.1 3.7 ~ 4.5, 26.8 ~ 32.5	W/O-ring Avec/joint torique W/O-Ring 58.8 ~ 78.5 N.m 6 ~ 8 kgf.m, 43.4 ~ 57.9 ft-lbf	*	0. <b>7</b> 5 in 19 mm	*When in steel pipe is in use.	0.47in 12 mm
3/8"	39.2 ~ 49.0 4.0 ~ 5.0, 28.9 ~ 36.2	W/O-ring  Avec/joint torique  W/O-Ring  78.5 ~ 98.1 N.m  8 ~ 10 kgf.m, 57.9 ~ 72.3 ft.lbf	*	0.91 in 23 mm	*En cas d'emploi d'un conduit d'acier.	0.59 in 15 mm
1/2"	49.0 ~ 68.6 5.0 ~ 7.0, 36.2 ~ 50.6	W/O-ring  Avec/joint torique  W/O-Ring  117.7 ~ 137.3 N.m  12 ~ 14 kgf.m, 86.8 ~ 101.3 ft.lbf	*	1.02 in 26 mm		0.63 in 16 mm

(3) Nuts Ecrous

Steel pipe size (O.D. x I.D. x Thickness) Cote du conduit d'acier (dimension interne externe et épaisseur)	Tightness torque Couple de serrage N.m kgf.m, ft.lbf	Spanner size (reference) Taille de la clé (référence)	Remarks Remarques
0.31 x 0.24 x 0.04 in	29.4 ~ 39.2	* 0.67 in	
φ8 x 6 x 1 mm	3.0 ~ 4.0, 21.7 ~ 28.9	17 mm	
0.39 x 0.28 x 0.06 in	39.2 ~ 44.1	* 0.75 inn	
\$\phi\$10 x 7 x 1.5 mm	4.0 ~ 4.5, 28.9 ~ 32.5	19 mm	
0.47 x 0.35 x 0.06 in	53.9 ~ 63.7	* 0.83 inn	* When sleeve nut is in use  * En cas d'emploi d'un conduit d'acier
\$\phi\$12 x 9 x 1.5 mm	5.5 ~ 6.5, 39.7 ~ 47.0	21 mm	
0.63 x 0.47 x 0.08 in	88.3 ~ 98.1	* 1.14 inn	En cas a emploi a un conduit a acier
φ16 x 12 x 2 mm	9.0 ~ 10.0, 65.1 ~ 72.3	29 mm	
0.71 x 0.55 x 0.08 in	127.5 ~ 137.3	* 1.26 in	
φ18 x 14 x 2 mm	13.0 ~ 14.0, 94.0 ~ 101.3	32 mm	
1.07 x 0.85 x 0.11 in	235.4 ~ 254.97	* 1.61 in	
φ27.2 x 21.6 x 2.8 mm	24.0 ~ 16.0, 173.6 ~ 188.1	41 mm	

## (4) Tightness torque of bolts and nuts

Couple de serrage des écrous et boulons

• Refer to the tightness torque table below.

• Se référer à la table des couples de serrage ci-dessous.

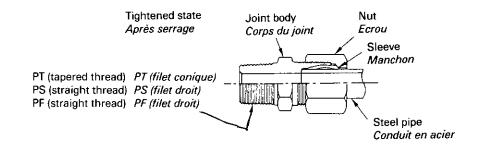
Bolts, Nuts Boulons, Ecrous	4T 💿	π 🕠	9Т 😉
Nominal Dia.  Dia. nominal	SS41	S40C, S45C	SCr4
M6	7.8—9.3 N.m	9.8—11.3 N.m	12.3—14.2 N.m
	0.80—0.95kgf.m, 5.8—6.9ft-lbf	1.00—1.15kgf.m, 7.2—8.3ft-lbf	1.25—1.45kgf.m, 9.0—10.5ft.lbf
M8	17.7—20.6 N.m	23.5—27.5 N.m	29.4—34.3 N.m
	1.80—2.10kgf.m, 13.0—15.2ft.lbf	2.40—2.80kgf.m, 17.4—20.3ft-lbf	3.00—3.50kgf.m, 21.7—25.3ft.lbf
M10	39.2—45.1 N.m	48.0—55.9 N.m	60.8—70.6 N.m
	4.00—4.60kgf.m, 28.9—33.3ft.lbf	4.90—5.70kgf.m, 35.4—41.2ft.lbf	6.20—7.20kgf.m, 44.8—52.1ft-lbf
M12	62.8—72.6 N.m	77.5—90.2 N.m	103.0—117.7 N.m
	6.40—7.40kgf.m, 46.3—53.5ft-lbf	7.90—9.20kgf.m, 57.1—66.5ft.lbf	10.50—12.00kgf.m, <b>7</b> 5.9—86.8ft.lbf
M14	107.9—125.5 N.m	123.6—147.1 N.m	166.7—196.1 N.m
	11.00—12.80kgf.m, 79.6—92.6ft.lbf	12.60—15.00kgf.m, 91.1—108.5ft.lbf	17.00—20.00kgf.m, 123.0—144.7ft.lbf
M16	166.7—191.2 N.m	196.1—225.6 N.m	259.9—304.0 N.m
	17.00—19.50kgf.m, 123.0—141.0ft-lbf	20.00—23.00kgf.m, 144.7—166.4ft-lbf	26.50—31.00kgf.m, 191.7—224.2ft-lbf
M18	245.2—284.4 N.m	274.6—318.7 N.m	343.2—402.1 N.m
	25.00—29.00kgf.m, 180.8—209.7ft.lbf	28.0—32.50kgf.m, 202.5—235.1ft.lbf	35.00—41.00kgf.m, 253.2—296.5ft.lbf
M20	333.4—392.2 N.m	367.7—431.5 N.m	490.3—568.8 N.m
	34.00—40.00kgf.m, 245.9—389.3ft-lbf	37.50—44.00 kgf.m, 271.2—318.2ft-lbf	50.00—58.00kgf.m, 361.6—419.5ft.lbf

### (4) Types and materials of bolts and nuts

Différents modèles de boulons et d'écrous, matériaux

[Hex. bolts]
[Boulons à 6 pans]

Types <i>Modèles</i>	Material Matériaux	Tensile strength Force de tension	Hardness <i>Dureté</i>		Bolt head marking trage a la tête du boulon
41	SS41	Over 392 MPa (4000 kgf/cm², 56892 lbf/in²) <i>Au-dessus de</i>	H <sub>R</sub> B 62 ~ 98	4	No mark or marked 4 Pas de repère ou repère 4
7Т	S40C S45C	Over 686 MPa (7000 kgf/cm², 99561 lbf/in²)  Au-dessus de	H <sub>R</sub> C 20~28	7	Marked 7 <i>Repère 7</i>
9Т	SCr4	Over 882 MPa (9000 kgf/cm², 128007 lbf/in²) <i>Au-dessus de</i>	H <sub>R</sub> C 28~34	9	Marked 9 Repère 9



# K. Hose List Liste des durites <R510 (B)> S/N 10001 ~

No. Code No.		Location to use Emplacement pour usage			Hose in. (mm) Durite (mm)		Joint Raccord		Guard spring
				Total length: L Longueur totale: L	Type <i>Type</i>	Cutting length: e Longueur de coupe: e	A	В	Ressort de garde
1	68881-63333	Main pump ~ Steering controller Pompe principale ~ Contrôleur de direction	1	725				SF-PF 3/4-N30	
2	68881-34910	Steering controller Contrôleur de direction	2	1100	3000-06		SA-PT 3/8	SF-PF 3/8	YMSN-06
3	68881-63350	Steering controller ~ C/V Contrôleur de direction ~ C/V	1	990				SL-PF 3/4-N30	
4	68881-64314	Charge pump ~ HL valve Pompe de charge ~ Soupape HL	1	935	3000-08			SL-PF 1/2	_
5	68881-63730	C/V T port ~ Return pipe Orifice T C/V ~ Tuyau de retour	1	770				SF-PF 3/4	
6	68881-64140	LST pump ~ LST motor Pompe LST ~ LST moteur	2	455			SF-PF 3/4	SF-PF3/4 Elbow 90°	
7	68881-64420	Charge pump ~ LST filter flange Pompe de charge ~ Bride de filtre LST	1	910	1000-06			SF-PF 3/8	YM10-06
8	68881-64520	LST filter flange ~ Charge pump Bride de filtre LST ~ Pompe de charge	1	1300				SF-PF 1/2	YM10-08
9	68881-32714	Charge pump ~ Parking brake Pompe de charge ~ Frein de stationnement	1	700	N3130-04	_	SL-PF 1/4	SF-PF 1/4	YM10-04
10	68881-73120	Lift cylinder Véring de levage	4	615			SA-PT R3/8	SF-PF 3/8	
11	68881-73320	C/V ~ Tilt cylinder C/V ~ Verin de tilt	2	915	3000-08	_	SA-PT R1/2	SF-PF 1/2	
12	68881-63970	Carry over hose Durite de transport	1	925				SF-PF 374	
13	68881-63990	Hose B. H. Tuyau de B. H.	1	1060	N3000-10		SA-PT 3/4-N30		
14	68869-68120	C/V coupler C/V coupleur	1	850	N3010-08	766	SA-PT 08-N30-901		
15	68849-68362	Outrigger Stabilisateur	2	445	N3010-04	377	SA-PT 04-N30	SF-PF 04-N30	
16	68849-68362	Outrigger Stabilisateur	2	370	N3010-04	302	SA-PT 04-N30	SF-PF 04-N30	
17	68817-68450	B. H. Slide section Section de glissement de B. H.	1	875	N3010-04	807	SA-PT 04-N30	SF-PF 04-N30	
18	68817-68540	Bucket block Bloc de godet	2	1055	N3010-06	979	SA-PT 06-N30	SF-PF 06-N30	
19	68817-68550	Arm cylinder Vérin de bras	1	1030	N3010-06	954	SA-PT 06-N30	SF-PF 06-N30	YMSN-06
20	68817-68560	Arm cylinder Vérin de bras	1	1050	N3010-06	974	SA-PT 06-N30	SF-PF 06-N30	YMSN-06
21	68817-68630	Boom block Bloc de flèche	2	905	N3010-06	829	SA-PT 06-N30	SF-PF 06-N30	
22	68817-68640	Boom cylinder Vérin de flèche	1	1740	N3010-06	1679	SA-PT 06-N30	SL-PF 06-N30	YMSN-06
23	68817-68650	Boom cylinder Vérin de flèche	1	1745	N3010-06	1669	SA-PT 06-N30	SF-PF 06-N30	YMSN-06
24	68817-68830	Arm block Bloc de bras	2	970	N3010-06	894	SA-PT 06-N30	SF-PF 06-N30	
25	68817-68840	Bucket cylinder Vérin de godet	1	1560	N3010-06	1484	SA-PT 06-N30	SF-PF 06-N30	YMSN-06
26	68817-68860	Bucket cylinder Vérin de godet	2	700	N3010-06	622		SF-PF 06-N30	YMSN-06
27	68817-68880	Bucket cylinder Vérin de godet	1	1610	N3010-06	1534	SA-PT 06-N30	SF-PF 06-N30	YMSN-06
28	68817-68720	Swing block Bloc de rotation	1	920	N3010-04	852	SA-PT 04-N30	SF-PF 04-N30	
29	68817-68750	Swing block Bloc de rotation	1	1030	N3010-04	962	SA-PT 04-N30	SF-PF 04-N30	

No.	Code No. No. de code	Location to use  Emplacement pour usage	pcs/unit Pcs/unité	pcs/unit Hose in. (mm) Pcs/unité Durite (mm)			Joint Raccord		
	710. 00 0000			Total length: L Longueur totale: L	Type Type	Cutting length: e Longueur de coupe: e	A	В	Ressort de garde
1	68891-64730	Main Pump ~ Priority Valve Pompe principale ~ Soupape de priorité	1	350	HT-10		SF-PF 10-N30	SL-PF 10-N30	
2	68891-64670	Priority Valve ~ Steering Controller Soupape de priorité ~ Contrôleur de direction	1	585	N3000-06		AF45-PF 06-N30	SF-PF 06-N30	
3	68891-62780	Priority Valve ~ C/V Soupape de priorité ~ C/V	1					<del></del>	
4	68881-34910	Steering controller Contrôleur de direction	2	1100	3000-06		SA-PT 3/8	SF-PF 3/8	YMSN-06
5	68881-64314	Charge pump ~ HL valve Pompe de charge ~ Soupape HL	11	935	3000-08			SL-PF 1/2	
6	68881-63730	C/V T port ~ Return pipe Orifice T C/V ~ Tuyau de retour	1	770				SF-PF 3/4	
7	68881-64140	LST pump ~ LST motor Pompe LST ~ LST moteur	2	455			SF-PF 3/4	SF-PF3/4 Elbow 90°	
8	68881-64420	Charge pump ~ LST filter flange Pompe de charge ~ Bride de filtre LST	1	910	1000-06			SF-PF 3/8	YM10-06
9	68881-64520	LST filter flange ~ Charge pump Bride de filtre LST ~ Pompe de charge	1	1300				SF-PF 1/2	YM10-08
10	68881-32714	Charge pump ~ Parking brake Pompe de charge ~ Frein de stationnement	1	700	N3130-04		SL-PF 1/4	SF-PF 1/4	YM10-04
11	68881-73120	Lift cylinder Véring de levage	4	615			SA-PT R3/8	SF-PF 3/8	
12	68881-73320	C/V ~ Tilt cylinder C/V ~ Verin de tilt	2	915	3000-08		SA-PT R1/2	SF-PF 1/2	
13	68881-63970	Carry over hose Durite de transport	1	925				SF-PF 3?4	:
14	68881-63990	Hose B. H. Tuyau de B. H.	1	1060	N3000-10		SA-PT 3/4-N30		
15	68869-68120	CN coupler CN coupleur	1	850	N3010-08	766	SA-PT 08-N30		
16	68849-68362	Outrigger Stabilisateur	2	445	N3010-04	377	SA-PT 04-N30	SF-PF 04-N30	
17	68849-68362	Outrigger Stabilisateur	2	370	N3010-04	302	SA-PT 04-N30	SF-PF 04-N30	
18	68817-68450	B. H. Slide section Section de glissement de B. H.	1	875	N3010-04	807	SA-PT 04-N30	SF-PF 04-N30	
19	68817-68540	Bucket block Bloc de godet	2	1055	N3010-06	979	SA-PT 06-N30	SF-PF 06-N30	
20	68817-68550	Arm cylinder Vérin de bras	1	1030	N3010-06	954	SA-PT 06-N30	SF-PF 06-N30	YMSN-06
21	68817-68560	Arm cylinder Vérin de bras	1	1050	N3010-06	974	SA-PT 06-N30	SF-PF 06-N30	YMSN-06
22	68817-68630	Boom block Bloc de flèche	2	905	N3010-06	829	SA-PT 06-N30	SF-PF 06-N30	
23	68817-68640	Boom cylinder Vérin de flèche	1	1740	N3010-06	1679	SA-PT 06-N30	SL-PF 06-N30	YMSN-06
24	68817-68650	Boom cylinder Vérin de flèche	1	1745	N3010-06	1669	SA-PT 06-N30	SF-PF 06-N30	YMSN-06
25	68817-68830	Arm block	2	970	N3010-06	894	SA-PT 06-N30	SF-PF 06-N30	
26	<u> </u>	Bloc de bras  Bucket cylinder	1	1560	N3010-06	1484	SA-PT 06-N30	SF-PF 06-N30	YMSN-06
27	68817-68860	Vérin de godet  Bucket cylinder	2	700	N3010-06	622	30-1430	SF-PF 06-N30	YMSN-06
28	68817-68880	Vérin de godet  Bucket cylinder	1	1610	N3010-06	1534	SA-PT 06-N30	SF-PF 06-N30	YMSN-06
29	68817-68720	Swing block	1	920	N3010-04	<u> </u>	SA-PT	SF-PF	
30	<del> </del>	Swing block	1	1030	N3010-04		04-N30 SA-PT 04-N30	04-N30 SF-PF 04-N30	

# L. Parts Weight Poids des pièces

Part name / Nom de pièce	R510 (B)
I A-LST system/Système LST	
1 LST pump/LST pompe	121.4 (55.2)
2 LST motor/LST moteur	58.3 (26.5)
3 Filter flange assy/Ens. bride a filtre	5.9 (2.7)
4 HLP control valve assy/Ens. distributeur	2.4 (1.1)
5 Oil cooler/Refroidisseur	14.7 (6.7)
6 Suction filter/Filtre de succion	6.4 (2.9)
III Power Train/Groupe motopropulseur/Kraftübetragung	
1 Rear differential axle assy/Ens. pont arriere	418 (190)
2 Reduction gear case assy/Ens. transmission	66 (30)
3 Universal joint/Joint de cardan	26.4 (12)
4 Front differential azle assy/Essieu avant complete	407 (185)
5 Tire assy/Ens. pneu	169.4 (77)
IV Hydraulic system/ <i>Système hydraulique</i>	
1 Tandem gear pump assy/Pompe pignon	12.1 (5.5)
2 Loader control valve assy/Valve de contrôle du dhorgeur	14.3 (6.5)
3 Backhoe control valve assy/Valve de contrôle de la rétro cauceese	44 (20.0)
4 Steering controler assy/Valve de direction	17.6 (8.0)
5 Lift cylinder assy/Cyl. du soulevement	52.1 (23.7)
6 Tilt cylinder assy/Cyl. de l'inclinaison	53.9 (24.5)
7 Steering cylinder assy/Cyl. de direction	26.8 (12.2)
8 Boom cylinder assy/Cyl. de la fleche	46 (21)
9 Arm cylinder assy/ <i>Cyl. du bras</i>	46 (21)
10 Bucket cyliner assy/Cyl. du godet	40 (18)
11 Outrigger cylinder assy/Cyl. des stabilisateurs	27.1 (12.3)
12 Swing cylinder tube assy/Cyl. Envelope du cyoindre de rotation	17.2 (7.8)
13 Swing cylinder piston rod/Tige de piston	31.7 (14.4)
14 Lock cylinder assy/Cyl. de verrou	3.3 (1.5)
15 Piping block/Bloc de tuyceeterie	8.8 (4.0)
VI Front attachment/ <i>Accessoire avant</i> /Vorderes Werkzeug	
1 Cutting edge/Bord de coupe	68.4 (31.1)
2 Standard bucket/Godet standard	352.4 (160.2)
3 Tilt link assy/Ens. maillon d'inclinaison	25.3 (11.5)
4 Tilt arm assy/Ens. bras de inclinaison	111.1 (50.5)
5 Shovel frame assy/Ens. chassis de pelle	464.2 (211)

	Part name / Nom de pièce	R510 (B)
/II Ma	achine structure/ <i>Structure de machine</i>	
1 F	ront frame/Chassis avant	660 (300)
2 F	Rear frame/Chassis d'arriere	902 (410)
3 (	Center shaft/Arbre centrale	118.8 (54)
4 (	Center pin/Goupille centrale	26.4 (12)
5 E	nd plate/Plaque de fond	7.9 (3.6)
6 5	Stand comp/Bequille	63.8 (29)
7 E	Sonnet/Capot superieur	90.9 (41.3)
8 E	Bonnet cover/Couvert capot	41.1 (18.7)
9 5	Seat assy (Loader type)/Ens. siège (Type pelleteuse) Backhoe type)/Ens. siège (Type pelle rétrocaveuse)	20.9 (9.5)
10 F	Radiator grill 1/Grillage de radiateur	9.9 (4.5)
11 (	Counter weight/Contrepoid	1650 (750)
12 5	Steering wheel assy/Ens. volant de direction	4.4 (2.0)
13 8	Steering post assy/Colonne de direction	8.8 (4.0)
14 (	Canopy assy (Rops/Fops)/Cadre de sécurité	242 (110)
15 (	Cab assy (Rops/Fops)/Ens. cabine (Rops/Fops) Without B.H./With B.H./Sans BH, avec BH	653.4 (297) 682 (310)
/HI 8	ackhoe/Pelle rétrocaveuse/Hecktieflöffel	
1 [	Backhoe assy/Ens. pelle rétrocaveuse	1650 (750)
2 (	Outrigger column/Colonne de stabilisateur	11.0 (5.0)
3 (	Dutrigger plate/Plateau de stabilisateur	13.9 (6.3)
4 1	Mount bracket/Support de montage	
5	Slide bracket/Support de glissement	191.4 (87)
6	Swing bracket/Support de pivotement	68.2 (31.0)
7 :	Swing pinion/Pignon de pivotement	6.6 (3.0)
8	Spline boss/Bossage de cannelure	4.6 (2.1)
9	Fulcrum shaft/Arbre d'appui	3.3 (1.5)
10	Boom/ <i>Fléche</i>	178.2 (81.0)
11 .	Arm/Bras	110.9 (50.4)
12	Bucket link 1/Maillon, godet 1	14.3 (6.5)
13	Bucket link 2, 3/Maillon, godet 2, 3	13.6 (6.2)
14	Standard bucket assy/Ens. godet standard	121 (55)
15	Bucket tooch/Dents. godet	4.4 (2.0)
16	Slide frame/Châssis de glissement	364.5 (165.7)
17	Valve support/Support de soupape	147.4 (67)
X En	gine/ <i>Moteur</i>	
1	Engine assy/Ensemble de moteur	451 (205)
2	Battery/ <i>Batterie</i>	42.0 (19.1)
3	Air cleaner assy/ <i>Ensemble de filtre à air</i>	9.0 (4.1)
4	Rakiator/ <i>Radiateur</i>	27.5 (12.5)
5	Muffler/Silencieux	12.8 (5.8)
6	Starter assy/Ensemble de démarreur	11.7 (5.3)
7	Alternator assy/Ensemble d'alternateur	6.6 (3.0)

# M. Conversion Table

### Tableau de conversion d'unité

	cm	m	mm	in	ft	Yd
	1	0.01	10.0	0.39370	0.0328080	0.01094
ا ج	100	1	1000	39.370	3.2808	1.0936
Length	0.100	0.00100	1	0.039370	0.0032808	0.001094
Lor	2.540	0.02540	25.400	1	0.083333	0.02778
	30.480	0.30480	304.800	12	1	0.3333
	91.44	0.9144	914.4	36	3	1

Note: 1 km = 0.6214 mile Note: 1 km = 0,6214 mile

	cm²	m²	in²	ft <sup>2</sup>	Yd <sup>2</sup>
	1	0.0001	0.15500	0.0010764	0.0001196
Area Surface	10000	1	1550.0	10.764	1.1960
	6.4516	0.00064516	1	0.006944	0.0007716
	929.03	0.092903	144.0	1	0.11111
	8361.0	0.8361	1296	9	1

Note: 1 acre = 0.404 ha Note: 1 acre = 0,404 ha

	dm <sup>3</sup> (l)	m³	ft <sup>3</sup>	yď³	gal	US gal
	1	0.001	0.035317	0.0013	0.21998	0.26418
Volume	1000	1	35.317	1.3080	219.98	264.19
Volu	28.3153	0.028315	1	0.0370	6.22786	7.4006
	4.5465	0.0045466	0.16057	0.0059	1	1.20114
	3.7852	0.0037852	0.13368	0.0050	0.83254	1

Note:  $1 \text{ m}^3 = 1.3080 \text{ Yd}^3 \ 1 \text{ cc} = 0.0610 \text{ in}^3$ 

Note:  $1 \text{ m}^3 = 1,3080 \text{ Yd}^3$ 

°F	°C
0	~17.8
10	-12.2
20	-6.7
30	-1.1
32	0
40	4.4
50	10.0
60	15.6
70	21.1
80	26.7
90	32.2
100	37,8
110	43.3
120	48.9
130	54.4
140	60.0
150	65.6
160	71.1
170	76.7
180	82.2
190	87.8
200	93.3
210	98.9
212	100.0
220	104.4
230	110.0
240	115.6
Note: Co	nuoroian farmula

Note: Conversion formula Note: Formule de conversion

> $F = 32 + \frac{9}{5} C$  $C = \frac{5}{9} (F - 32)$

	ℓ/sec	m³/h	m³/min	gal/min	US gal/min	ft³/h	ft³/min
	1	3.6	0.060	13.197	15.8514	127.14	21.192
Ę	0.2778	1	0.016668	3.6658	4.4032	35.317	0.58806
Flow amount Débit	16.666	60.0	1	219.98	264.1833	2119.183	35.3165
N a Dél	0.075775	0.27279	0.0045465	1	1.2011	9.6342	0.16056
Ψ	0.06309	0.2271	0.0037824	0.8325	1	8.0208	0.17768
	0.007865	0.02832	0.0004719	0.1038	0.1247	1	0.016668
	0.47192	1.6989	0.02832	6.22787	7.4855	60.0	1

	N	dyn	kgf	lbw
Force Force	1	1 × 10 <sup>3</sup>	1.019 72 × 10 <sup>-1</sup>	2.248 09 × 10
	1 × 10 <sup>-3</sup>	1	1.019 72×10⁻⁴	2.248 09×10 <sup>-4</sup>
	9.806 65	9.806 65 × 10 <sup>3</sup>	1	2.204 62
	4.448 22	4.448 22 × 10 <sup>3</sup>	4.535 92×10 <sup>-1</sup>	1

	Pa	MPa or N/mm³	kgf/mm³	kgf/cm³	
ess ainte	1	1 × 10⁻⁴	1.019 72 × 10 <sup>-7</sup>	1.019 <b>72</b> × 10 <sup>-6</sup>	
Stress	1 × 10SS4	1	1.019 72 × 10 <sup>-1</sup>	1.019 72×10	
	9.806 65 × 10SS4	9.806 65	1	1 × 10 <sup>2</sup>	
	9.806 65×10SS4	9.806 65 × 10 <sup>-2</sup>	1 × 10 <sup>-2</sup>	1	

	Pa	bar	kgf/cm²	atm	mmH2O	mmHg or Torr	psi (lbw/in²)
	1	1 × 10 <sup>−5</sup>	1.01972 × 10 <sup>-5</sup>	9.869 23×10 <sup>-4</sup>	1.019 72 × 10 <sup>-1</sup>	7.500 62 × 10 <sup>-2</sup>	1.450 38 × 10 <sup>-4</sup>
	1 × 10 <sup>5</sup>	1	1.019 72	9.869 23×10 <sup>-1</sup>	1.019 72×10SS4	7.500 62 × 10 <sup>2</sup>	1.450 38×10
ure 100	9.806 65×10 <sup>1</sup>	9.806 65 × 10 <sup>-1</sup>	1	9.678 41 × 10 <sup>-1</sup>	1.000 0×10SS4	7.355 59 × 10 <sup>2</sup>	1.422 33×10
Pressure Pression	1.013 25×10 <sup>3</sup>	1.013 25	1.033 23	1	1.033 23×10SS4	7.600 00 × 10 <sup>3</sup>	1.469 59×10
G 9	9.806 65	9.806 65 × 10 <sup>5</sup>	1.000 0×10 <sup>-4</sup>	9.678 41 × 10 <sup>-5</sup>	1	7.355 59 × 10 <sup>3</sup>	1.422 33 × 10 <sup>-2</sup>
	1.333 22 × 10 <sup>2</sup>	1.333 22 × 10 <sup>-3</sup>	1.359 51 × 10 <sup>-3</sup>	1.315 79×10 <sup>-3</sup>	1.359 51 × 10	1	1.933 68 × 10 <sup>-2</sup>
	6.894 74×10 <sup>3</sup>	6.894 74×10 <sup>-2</sup>	7.030 70×10 <sup>-2</sup>	6.804 60 × 10 <sup>-2</sup>	7.030 70 × 10 <sup>2</sup>	5.171 50×10	1

Note: 1 Pa = 1 N/m<sup>2</sup>

Note: 1 Pression d'air = 1 N/m²

rceil	J	kw.h	kgf.m	kcal	ft.lb.
energy amount 'energie de trouv	1	2.777 78 × 10 <sup>7</sup>	1.019 72 × 10 <sup>-1</sup>	2.388 89 × 10 <sup>-4</sup>	7.375 55 × 10 <sup>-1</sup>
	3.600 × 10SS4	1	3.670 98 × 10 <sup>5</sup>	8.600 0 × 10 <sup>2</sup>	2.655 19 × 10SS4
	9.806 65	2.724 07 × 10 <sup>-4</sup>	1	2.342 70 × 10 <sup>-3</sup>	7.232 92
Work tant d	4.186 05 × 10 <sup>3</sup>	1.162 79×10 <sup>-3</sup>	4.268 58 × 10 <sup>2</sup>	1	3.087 43×10 <sup>3</sup>
Mont	1.355 83	3.766 21 × 10 <sup>4</sup>	1.382 57 × 10 <sup>-1</sup>	3.238 99×10 <sup>-4</sup>	1

Note: 1 J = 1 W.S, 1 W.h = 3600 W.S

1 cal = 4,186 05J (mesuré par méthode de calorie)

1 cal = 4.186 05J (measured by calorie method)

Note: 1 J = 1 W.S, 1W.h = 3600 W.S

① Rendement	de travail	Italiy da	production	accietance
- U Henaement	de travaii	maux ae	broauction.	assistance)

4, 6	kW	kgf.m/s	PS	HP	ft.lb./s
ncy rate, ⊕ ©	1	1.019 22 × 10 <sup>2</sup>	1.359 62	1.340 48	7.375 52 × 10 <sup>2</sup>
efficie uction tance)	9.806 65 × 10 <sup>-3</sup>	1	1.333 33×10 <sup>-2</sup>	1.314 56×10 <sup>-2</sup>	7.2332 92
Work ef (product assistan	7.355 × 10 <sup>-1</sup>	7.5 × 10	1	9.859 25 × 10 <sup>-1</sup>	5.424 69 × 10 <sup>2</sup>
	7.46 × 10⁻¹	7.607 07×10	1.014 28	1	5.502 13 × 10 <sup>2</sup>
	1.355 84 × 10 <sup>-1</sup>	1.382 57×10 <sup>-1</sup>	1.843 42 × 10 <sup>-3</sup>	1.817 48×10 <sup>-3</sup>	1

Note: 1 W = 1 J/S, 1kW = 1000 N.m/s Note: 1 W = 1 J/S, 1W = 1000 N.m/s

### N. Traction Procedure 2

The LST and negative brake are installed on R310, R410 and R510. When a problem occurs to the engine or LST, the wheel loader cannot be tracted as it is. Preparation necessary for tracting a wheel loader is informed.

- 1. R310, R410 and R510 Traction Procedure
  - (1) Preparation

The following preparations are necessary to tract R510 (details are described on the following pages).

- Bypassing the looped circuit
- Releasing the negative parking brake

#### (2) Traction

- 1 For forward traction, pull the faulty wheel loader by hooking wire ropes to both front wheels.
  - Note: Never hook wire ropes to the bucker or other working mechanism.
- 2 For reverse traction, pull the faulty wheel loader by hooking wire ropes to the weight.
- (3) Precautions
  - When a faulty wheel loader is tracted with an operator on the vehicle, always check that the foot brake is effective.
  - 2 Always keep the speed at 1 km/h or less.

Note: Since the motor is driven by rotating tires during traction, the motor is rotated at high speeds if traction speed is high, causing new problems.

3 Avoid tracting a long distance (200 meters or less).

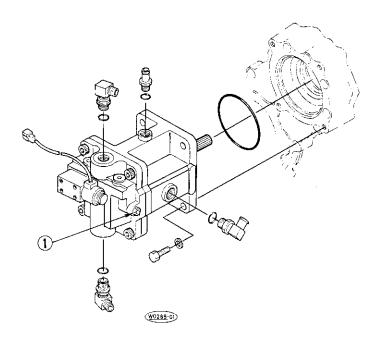
Note: Since the charge circuit does not function during traction, oil in the motor is reduced gradually. Tracting a wheel loader a loader a long distance causes burning of the motor.

#### 2. Detailed Procedures

- (1) Releasing the looped circuit
  - Loosen the bypass valve lock nut of the LST motor then turn the bypass valve counterclockwise 1.5 times, Retighten the lock nut.

(Never turn the bypass valve 2 times or more.)

Note: After traction, tigten the bypass valve and the lock nut to the specified torque.



1 Bypass valve lock nut

# (2) Releasing the negative parking brake

 Remove the upper and lower bolts securing the negative brake then remove two plain washers, Retigten the bolts.

Note: After traction, install the two plain washers, tighten the bolts and check that the brake functions correctly.

Bypass valve (holo-spanner 6)
 Tightening torquet 7.2 ft-1b (1 kgm)

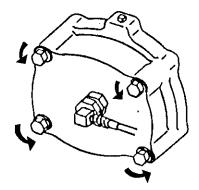
Nut (spanner 17)
 Tightening torque: 25.3 ~ 28.9 ft-1b
 (3.5 to 4.0 kgm)

 Section A-A
 Bypass valve

• Bolt (spanner 17)

Two plain washers

View B
P1
A
A
B
B
P1
LST motor
Foot
brake
piston
Brake assembly
Front of vehicle
Rear differentia



# Section II

# **A-LST System**

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# A. Specifications A. Caractéristiques

- a. Operational specification
- a. Caractéristiques fonctionnelle
- Travel speed
   Vitesse de déplacement

Model /	/lodèle	R510 (B)
F.H.	mile/h (km/h)	$10.0 \pm 0.3 \; (16.0 \pm 0.5)$
R.H.	sec./65 feet (20 m)	4.3~4.7
F.L.	mile/h (km/h)	4.35 ± 0.3 (7.0 ± 0.5)
R.L.	sec./65 feet (20 m)	9.6~11.0

#### Traction force Force de traction

,	R510 (B)
F.H. R.H.	1985 ± 220 lbf (900 ± 100 kgf) ≦
F.L. R.L.	6175 ± 220 lbf (2800 ± 100 kgf)≤

Oil temperature in tank: 122  $\pm$  41°F (50  $\pm$  5°C)

# Start-up engine RPM Régime du moteur au démarrage

	R510 (B)	
F.L.	1100 <sup>+50</sup> rpm	
F.H.		

# Gradeability Taux de pente à gravir

	R510 (B)
F.H.	mini. 15° or more Egal ou supérieur à 15°
F.L.	mini. 30° or more <i>Egal ou supérieur à 30</i> °

### 5. Travelling block performance on slope condition

#### 5. Performances du bloc de déplacement dans les pentes

Direction	Descending distance	Condition
Direction	Distance de descente	Condition
F.L	$6.56 \pm 1.64 \text{ ft/30 sec}$ (2.0 $\pm$ 0.5 m/sec)	Machine without load, STD counterweight  Machine, charge à vide, avec contre-poids standard  Slope angle: 15° angle, Oil temp, 122 ± 41°F (50 ± 5°C)
	<9.84 ft/30 sec <u>∧</u> (<3.0 m/30 sec)	Angle, température d'huile 50 ± 5°C Engine idling and neutral position. Ralenti du moteur et point mort

### 6. Travelling drifting performance

#### 6. Performances de tirage de déplacement

Range <i>Plage</i>	Drifting distance Distance de tirage	Condition  Condition
Hi F ↔ R	3.28 ft (1.0 m)	Engine Max. rated RPM, No load with STD counterweight Régime nominal max. du moteur, charge à vide, avec contre-poids standard  Oil temp: $122 \pm 41^{\circ}F$ ( $50 \pm 5^{\circ}C$ ) FR lever quick shifting Température d'huile $50 \pm 5^{\circ}C$ , passage rapide du levier F-R (av/ar)
	Ground; flat, hard surface.  Sol plat, à surface dure.	

#### 7. LST dynamic brake performance

#### 7. Performances dynamique des freins LST

Range	Braking distance		Condition
Plage	Distance de tirage	,	Condition
Lo	3.28 ± 1.64 ft	( m)	Engine Max rated RPM, No load with STD counterweight Oil temp: 122± 41°F (50 ± 5°C)
	$(1.0 \pm 0.5 \text{ m})$		Régime nominal max. du moteur, charge à vide, avec contre-poids standard, température d'huile 50 ± 5°C
Hi	13.12 ± 1.64 ft	( m)	After getting max travelling speed, release the accelerator pedal, and take measurement of braking distance.
$(4.0 \pm 0.5 \text{ m})$			A la vitesse de déplacement maximale, relâcher la pédale d'accélérateur et mesurer la distance de freinage.

# b. Parts Specifications

### b. Caractéristiques des pièces

# 1. LST pump 1. Pompe LST

Machine model Modèle de machine	R510 (B)		
Pump model Modèle de pompe	PSVH-45CS-HS		
Type Type	Variable displacement axial piston pump  Pompe piston axial à cylindrée variable		
Drive system Système d'entraînement	Direct drive by engine crankshaft via flange coupling  Entraînement direct par vilebrequin du moteur via accouplement à bride		
Displacement Cylindrée		± 2.75 in <sup>3</sup> /rev (± 45 cc/rev)	
Swash plate angle Angle de plateau isolant			
Pump input RPM Régime d'entrée de pompe		900 ~ 2700 rpm	
Max. high pressure relief setting (at bench) Réglage de décompression de haute pression max. (sur banc)	5335 $\pm$ 70 psi at 1.32 gal/min (375 $\pm$ 5 kgf/cm² at 5 $\ell$ /min		
Charge relief setting pressure (at bench) Pression de réglade de décompression de charge (sur banc)	215 psi (15kgf/cm²) at 1000rpm		
Input engine torque, Gross SAE Couple du moteur d'entrée	110.6 ft•lbs (15.3 kgf•m)/1800rpm		
In line filter Filtre en ligne	10 μmm		
Allowable oil temp Température d'huile de carter admissible	Oil tank: 5 ~194°F (-15~90°C)	LST system 5°~230°F (-15°~ +110°C)	
Operating oil Huile de service	SAE 10W30 or equivalent  SAE 10W30 ou équivalent		
Operating oil viscosity range Viscosité d'huile de service	Recommended range:  Gamme préconisée  25 ~ 500 cst	Applicable range:  Gamme applicable  20 ~500 cst	
Oil contamination limit  Limite de contamination d'huile	Within NAS 9 class  Dans les limites de classe NAS 9		
Max. pump case pressure Pression de carter de pompe max.	Normal operation: 14.2 psi (1.0 kgf/cm²) Instantaneous Max. 42.7 psi (3.0 kgf/cm²)		
Bypass valve relief pressure Pression de décompression de clapet de dérivation	20 noi (1 E kaf(am²)		

(Note) Above pressure values indicate the bench set result as a single pump unit.

(Note) Les valeurs de pression ci-dessus indiquent le résultat de réglage sur banc comme unité de pompe unique.

### 2. Servo-regulator

### 2. Servo-régulateur

Inching control range	0 ~ 90° OFF: 35° ON: 60°	
Cut-off relief valve setting, bench	psi, kgf/cm <sup>2</sup>	
Start-up relief valve setting, bench		
Low pressure relief valve setting	215 psi (15 kgf/cm²) at 1000 rpm	•
F.R solenoid valve	Voltage: 12V, Current: 2.2A max. Coil resistance: 5.6 Ω Energized at A= Reverse= P1 port Energized at B= Forward= P2 port	
Horse power control valve setting		

#### 3. LST motor

### 3. Moteur LST

Machine model Modèle de machine	R510 (B)	
Motor model Modèle de moteur	MSF-65V	
Туре <i>Туре</i>	Variable displacement axial piston motor  Moteur à piston axial à cylindrée variable	
Max. discharge Décharge max.	3.97 in <sup>3</sup> /rev (65 cc/rev) at °	
Mini. discharge <i>Décharge min.</i>	1.68 in <sup>3</sup> /rev (27.5 cc/rev) at °	
Max. RPM		
Régime max.	5000 rpm	
Theoretical output torque at max. pressure (5335 psi, 375 kgf/cm²)	Low: 279.9 ft•lb (38.7 kgf/cm), High: 118.6 ft•lb (16.4 kgf•m)	
Couple de sortie théorique à la pression max. 375 kgf/cm²	Bas 38,7 kgf.m Elevé 16,4 kgf.m	
Anti-cavitation valve cracking pressure Pression de craquelure de la soupape	1.42~4.27 psi (0.1~0.3 kgf/cm²)	
anti-cavitaion	0,1 - 0,3 kgf/cm²	
Max. unit durable high pressure Pression hante durable d'unité max	5335 rsi (375 kg/cm²)	
Max. case pressure, bench Pression de carter max.	14.2 psi (1.0 kgf/cm²)	
Motor output shaft rotation direction viewed from shaft end)	P1 port pressurized: Clock wise, P2 port pressurized: Counter clockwise	
Direction de rotation de l'arbre de sortie moteur (vue de l'extrémité de l'arbre)	Lumière P1 pressurisée : dans le sens des aiguilles d'une montre, lumière pressurisée : dans le sens contraire des aiguilles d'une montre	
Allowable oil temp. Température d'huile de carter admissible	Oil tank: LST system: 5° ~ 230°F (-15 ~+110°C) 5~194°F (-15~90°C)	
Operating oil Huile de service	SAE 10W30 or equivalent  SAE 10W30 ou équivalent	
Oil contamination limit  Limite de contamination d'huile	Within NAS 9 class  Dans les limites de classe NAS 9	
In line filter Filtre en ligne	Nominal 10μmm Nominal 10 μmm	
Hi-Low Piston dia. Dia. de piston Hi-Low	·	
Piston stroke Course de piston		

### 4. Charge pump

### 4. Pompe de charge

Charge pump type	KRP4-23-9C	KRP4-23-7C
Discharge rate x 2600 rpm	0.57 cu.in./rev (9.4 cc/rev)	0.43 cu.in./rev (7.0 cc/rev)
Taux de décharge x 2600 tr/min	6.46 gal/min. (24.44ℓ min)	4.81 gal/min. (18.2 ½/min)
Max. allowable pressure Pression admissible max.	2490 psi (1	75 kgf/cm²)

# 5. Filter flange 5. Bride de filtre

Element code No.	10 μmm, 68841-62281		
Flow rate Débit	5.15 gal/min (19.5 l/min.)		
Element durable pressure Pression de décompression d'élément	242 psi (17 kgf/cm <sup>2</sup> )		
Filter clog sensing pressure switch Pression de détection d'obstruction de filtre	100 psi (7.0 kgf/cm²)		
Bypass valve cracking pressure Pression de craquement de clapet de dérivation	193.4 psi (13.6 kgf/cm²)		
Spring dia. x free length Dia. de ressort × longueur libre	0.57 in x 1.61 in. (φ14.5 x 41 mm)		

# 6. Suction filter 6. Filtre d'aspiration

Filter screen Ecran de filtre	40 μmm
Relief valve cracking pressure Pression de craquement de clapet de décompression	$4.3 \sim 5.7 \text{ psi } (0.3 \sim 0.4 \text{ kgf/cm}^2)$

# 7. Oil cooler 7 Réfrigérant d'huile

'		R510 (B)
Heat radiating area Surface de radiation de chaleur Cooling capacity Capacité de refroidissement		6.28 yd <sup>2</sup> (5.25 m <sup>2</sup> )
		5700 kcal/h
<condition> <condition></condition></condition>	Oil flow rate Débit d'huile	2.64 gal/min (10 l/min)
	Fan speed Vitesse de ventilateur	19.7 ft/sec (6 m/sec)
	Temp. differential Différentiel de température	122°F (50°C)
Operating pressure Pression de service	50°F (10°C) or more 10°C ou plus	170 psi (12 kgf/cm²) or less
	5°F (-15°C)	285 psi (20 kgf/cm²) or less
Pressure loss Perte de pression		2.56 psi (0.18 kgf/cm <sup>2</sup> )

# 8. Oil thermo switch 8. Contacteur thermique d'huile

8. Contacteur thermique a name	
Type Type	
Switch-on temperature Température de fermeture	239 ± 35°F (115 ± 2°C)

# 9. Pressure switch 9. Contacteur de pression

J. CONTROLL TO P. CO. C.				
Type Type				
Switch-on pressure Pression de fermeture	99.6 $\pm$ 20 psi (7 $\pm$ 1.5 kgf/cm <sup>2</sup> )			

# c. Maintenance specifications

Testing Items	Bench test	Machine test	Engine RPM
High pressure relief valve (F-R)	5335 psi (375 kgf/cm²)	5120 ± 285 (360 ± 20 kgf/cm <sup>2</sup> )	2600
Charge pump pressure		427 ± 70 psi (30 ± 5 kgf/cm <sup>2</sup> )	1000
		1565 ± 215 psi (110 ±15 kgf/cm²)	2600
Low pressure relief valve (charge relief valve)	213 psi (15 kgf/cm <sup>2</sup> )	192 ± 70 psi (13.5 ± 0.5 kgf/cm <sup>2</sup> )	1000
		220 ± 14 psi (15.5 ± 1.0 kgf/cm <sup>2</sup> )	2600
Servo-regulator control pressure differential IC1 - C2I		84 ± 14 psi (6.0 ± 1.0 kgf/cm <sup>2</sup> )	2600
Front main relief pressure	2490 <sup>+40</sup> psi (175 <sup>+3</sup> kgf/cm <sup>2</sup> )	2775 ± 70 psi (195 ± 5 kgf/cm²)	2600
Front overload relief pressure	3270 <sup>+40</sup> psi (230 <sup>+3</sup> kgf/cm <sup>2</sup> )	3625 ± 140 psi (255 ± 10 kgf/cm²)	2600
Steering controller main relief pressure	2490 <sup>+40</sup> psi (175 <sup>+3</sup> kgf/cm <sup>2</sup> )	2630 ±70 psi (185 ± 5 kgf/cm²)	2600

Charge pump flow rate	Theoretical di	scharge 0%) x 2600rpm	0.57 in³ (9.4 cc/rev) 6.46 gal/min (24.4 ℓ/min)
	Factory spec	No load	$0.56 \pm 0.01 \text{ in}^3 (9.2 \pm 0.2 \text{ cc/rev}) \\ 6.31 \pm 0.13 \text{ gal/min} (23.9 \pm 0.5 \text{g/min})$
		Load (95% ≤) 1705 psi (120 kgf/cm²)	$0.54 \pm 0.01 \text{ in}^3 (8.85 \pm 0.2 \text{ cc/rev})$ $6.08 \pm 0.13 \text{ gal/min} (23.0 \pm 0.5 \text{l/min})$
Main pump flow rate	Theoretical di	scharge )%) x 2600 rpm	1.40 in <sup>3</sup> (22.9 cc/rev) 15.73 gal/min (59.54½/min)
	Factory spec	No load 355 psi (25 kgf/cm²)	$1.38 \pm 0.03 \text{ in}^3$ (22.65 $\pm 0.5 \text{ cc/rev}$ ) 15.56 $\pm 0.34 \text{ gal/min}$ (58.89 $\pm 1.3 \text{ l/min}$ )
		Load (95 % ≤) 2775 psi (195 kgf/cm²)	1.32 ± 0.03 in <sup>3</sup> (21.65 ± 0.5 cc/rec) 14.87 ± 0.34 gal/min (56.29 ± 1.3½/min)

LST pump delivery rate	Theoretical disc	harge (100%) x 2600rpm	0~2.745 in <sup>3</sup> (0~45 cc/rev) 0~30.9 gal/min (0~117ℓ/min)	
	New machine Condition	Load : 710 psi (50 kgf/cm²)	$2.68 \pm 0.15 \text{ in}^3 (44.0 \pm 2.5 \text{ cc/rev})$ 29.59 gal/min (110.0 $\ell$ /min) at 2550 rpm	
		1420 psi (100 kgf/cm²)	2.62 ± 0.12 in <sup>3</sup> (43.0 ± 2.0 cc/rev) 28.40 gal/min (107.5l/min) at 2500rpm	
		2135 psi (150 kgf/cm²)	2.20 ± 0.09 in <sup>3</sup> (36.0 ± 1.5 cc/rev) 22.85 gal/min (86.5ℓ/min) at 2400 rpm	
		2840 psi (200 kgf/cm²)	$1.71 \pm 0.06 \text{ in}^3 (28.0 \pm 1.0 \text{ cc/rev})$ 16.25 gal/min (61.5 $\ell$ /min) at 2200 rpm	
LST motor delivery rate	Theoretical disc	harge	Lo : 3.97 in <sup>3</sup> Hi : 1.68 in <sup>3</sup> Lo : 65.0 cc/rev Hi : 27.5 cc/rev	
	New machine Condition	Load : 710 psi (50 kgf/cm <sup>2</sup> )	2.59 ± 0.15 in <sup>3</sup> (42.5 ± 2.5 cc/rev) 28.6 gal/min (108.5½/min) at 2550 rpm	
		1420 psi (100 kgf/cm²)	2.38 ± 0.12 in <sup>3</sup> (39 ± 2.0 cc/rev) 25.76 gal/min (97.5 l/min) at 2500 rpm	
		2135 psi (150 kgf/cm²)	1.74 ± 0.09 in <sup>3</sup> (28.5 ± 1.5 cc/rev) 16.91 gal/min (64.0½/min) at 2250 rpm	
		2840 psi (200 kgf/cm²)	1.13 ± 0.06 in <sup>3</sup> (18.5 ± 1.0 cc/rev) 10.70 gal/min (40.5½/min) at 2200 rpm	

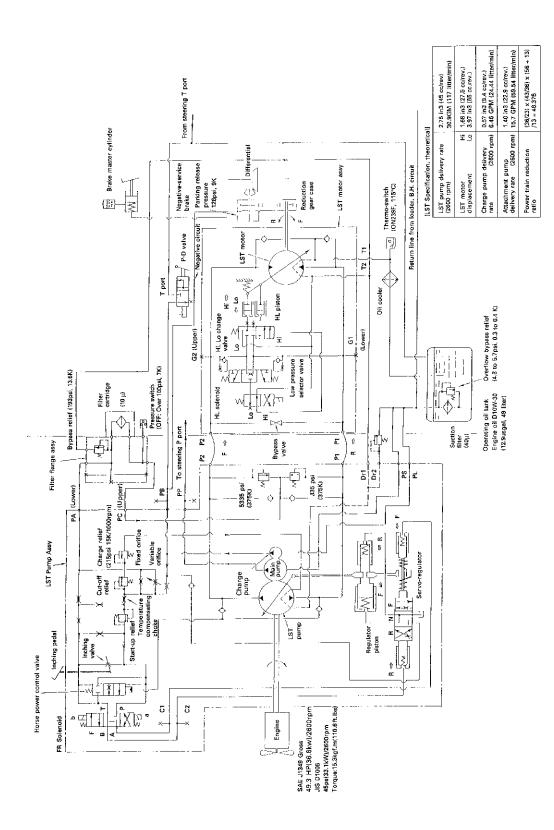
II-6

# c. Maintenance specifications $\triangle\, \triangle$

Testing Items	Bench test	Machine test	Engine RPM
High pressure relief valve (F·R)	5335 psi (375 kgf/cm²)	$5405 \pm 425 \text{ psi} \ (380 \pm 30 \text{ kgf/cm}^2)$	2600
Charge pump pressure		$398 \pm 30 \text{ psi} \ (28 \pm 2 \text{ kgf/cm}^2)$	1000
		1350 $\pm$ 115 psi (95 $\pm$ 8.0 kgf/cm <sup>2</sup> )	2600
Low pressure relief valve (Charge relief valve)	213 psi (15 kgf/cm²)	213 $\pm$ 70 psi (15.0 $\pm$ 0.5 kgf/cm <sup>2</sup> )	1000
(Onlarge Tellor Valve)		228 $\pm$ 14 psi (16.0 $\pm$ 1.0 kgf/cm <sup>2</sup> )	2600
Servo-regulator control pressure differential IC <sub>1</sub> - C <sub>2</sub> I		$107 \pm 14 \text{ psi}$ $(7.5 \pm 1.0 \text{ kgf/cm}^2)$	2600
Front main relief pressure	2490 <sup>±40</sup> <sub>30</sub> psi (175 <sup>±2</sup> kgf/cm²)	2915 $\pm$ 70 psi (205 $\pm$ 5 kgf/cm <sup>2</sup> )	2600
Front overload relief pressure	3270 <sup>+40</sup> <sub>30</sub> psi (230 <sup>+3</sup> 2 kgf/cm²)	$3625 \pm 140 \text{ psi} \ (255 \pm 10 \text{ kgf/cm}^2)$	2600
Steering control main relief pressure	2490 <sup>+40</sup> <sub>-30</sub> psi (175 <sup>+3</sup> / <sub>2</sub> kgf/cm <sup>2</sup> )	$2560 \pm 70 \text{ psi} \ (180 \pm 5 \text{ kgf/cm}^2)$	2600
LST case pressure, Max.	14.2 psi (1.0 kgf/cm²)	$15.6 \pm 2.8 \text{ psi}$ $(1.1 \pm 0.2 \text{ kgf/cm}^2)$	2600, 50 °C (122 °F)

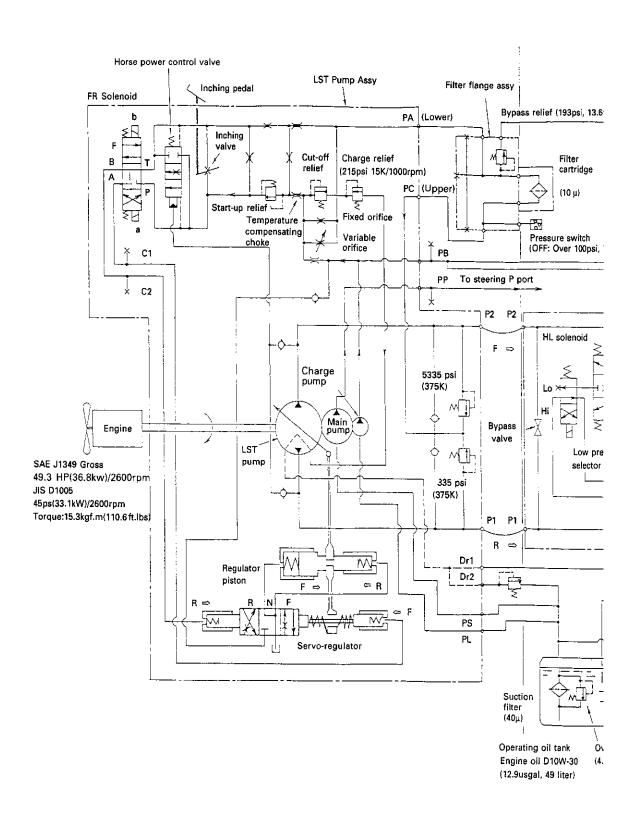
Charge pump flow rate	Theoretical di	scharge 0%) x 2600rpm	0.43 in³ (7.0 cc/rev) 4.81 gal/min (18.2 ½ /min)
	Factory spec	No load	$0.42 \pm 0.01$ in <sup>3</sup> (6.9 ± 0.2cc/rev) 4.73 ± 0.15 gal/min (17.9 ± 0.5 $\ell$ /min)
		Load (95% ≤) 1705 psi (120 kgf/cm²)	$0.40 \pm 0.01 \text{ in}^3 (6.56 \pm 0.2 \text{ cc/rev})  4.51 \pm 0.13 \text{ gal/min} (17.6 \pm 0.5 \ \ell /\text{min})$
Main pump flow rate	Theoretical discharge (100%) x 2600 rpm		1.40 in <sup>3</sup> (22.9 cc/rev) 15.73 gal/min (59.54½/min)
	Factory spec	No load 355 psi (25 kgf/cm²)	$1.38 \pm 0.03 \text{ in}^3 (22.65 \pm 0.5 \text{ cc/rev})$ $15.56 \pm 0.34 \text{ gal/min} (58.89 \pm 1.3 \text{l/min})$
		Load (95 % ≤) 2915 psi (205 kgf/cm²)	1.32 ± 0.03 in <sup>3</sup> (21.65 ± 0.5 cc/rec) 14.87 ± 0.34 gal/min (56.29 ± 1.31/min)

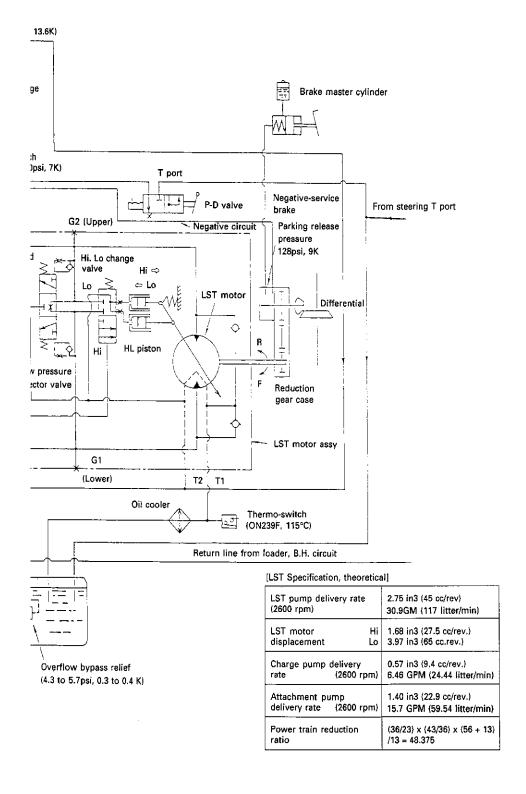
LST pump delivery rate	Theoretical disc	harge (100%) x 2600rpm	0~2.745 in <sup>3</sup> (0~45 cc/rev) 0~30.9 gal/min (0~117ℓ/min)	
	New machine Condition	Load : 710 psi (50 kgf/cm²)	$2.68 \pm 0.15 \text{ in}^3 (44.0 \pm 2.5 \text{ cc/rev})$ 29.59 gal/min (110.0 $\ell$ /min) at 2550 rpm	
		1420 psi (100 kgf/cm <sup>2</sup> )	2.62 ± 0.12 in <sup>3</sup> (43.0 ± 2.0 cc/rev) 28.40 gal/min (107.5½/min) at 2500rpm	
		2135 psi (150 kgf/cm²)	2.20 ± 0.09 in <sup>3</sup> (36.0 ± 1.5 cc/rev) 22.85 gal/min (86.5½/min) at 2400 rpm	
		2840 psi (200 kgf/cm²)	1.71 ± 0.06 in <sup>3</sup> (28.0 ± 1.0 cc/rev) 16.25 gal/min (61.5½/min) at 2200 rpm	
LST motor delivery rate	Theoretical disc	harge	Lo : 3.97 in <sup>3</sup> Hi : 1.68 in <sup>3</sup> Lo : 65.0 cc/rev Hi : 27.5 cc/rev	
	New machine Condition	Load : 710 psi (50 kgf/cm <sup>2</sup> )	$2.59 \pm 0.15 \text{ in}^3$ (42.5 ± 2.5 cc/rev) 28.6 gal/min (108.5 $\ell$ /min) at 2550 rpm	
		1420 psi (100 kgf/cm <sup>2</sup> )	2.38 ± 0.12 in <sup>3</sup> (39 ± 2.0 cc/rev) 25.76 gal/min (97.5 l/min) at 2500 rpm	
		2135 psi (150 kgf/cm²)	1.74 ± 0.09 in <sup>3</sup> (28.5 ± 1.5 cc/rev) 16.91 gal/min (64.0ℓ/min) at 2250 rpm	
		2840 psi (200 kgf/cm²)	$1.13 \pm 0.06 \text{ in}^3 (18.5 \pm 1.0 \text{ cc/rev})$ 10.70 gal/min (40.5 $\%$ /min) at 2200 rpm	

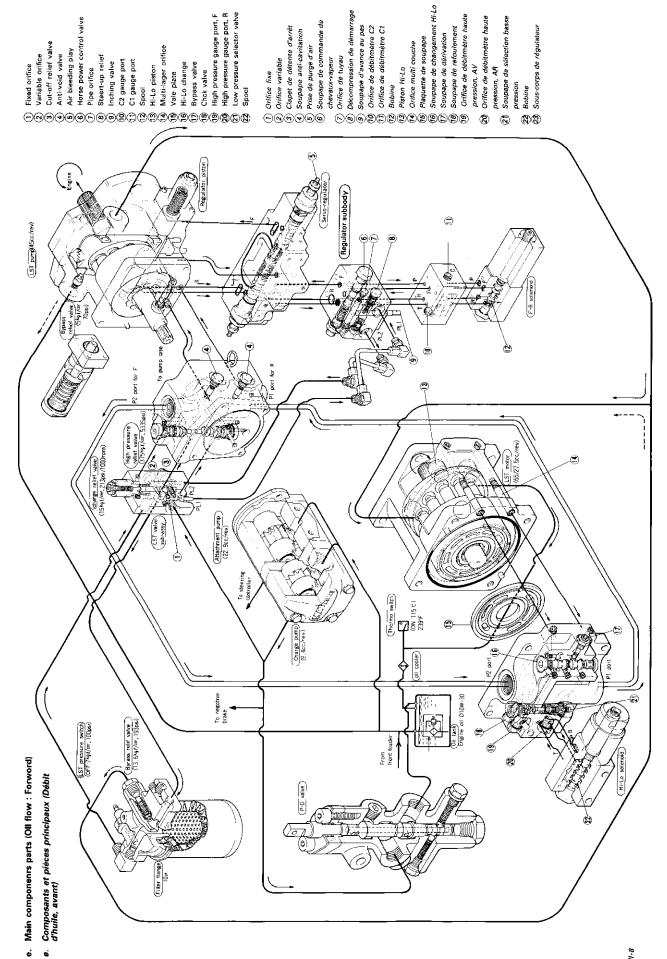


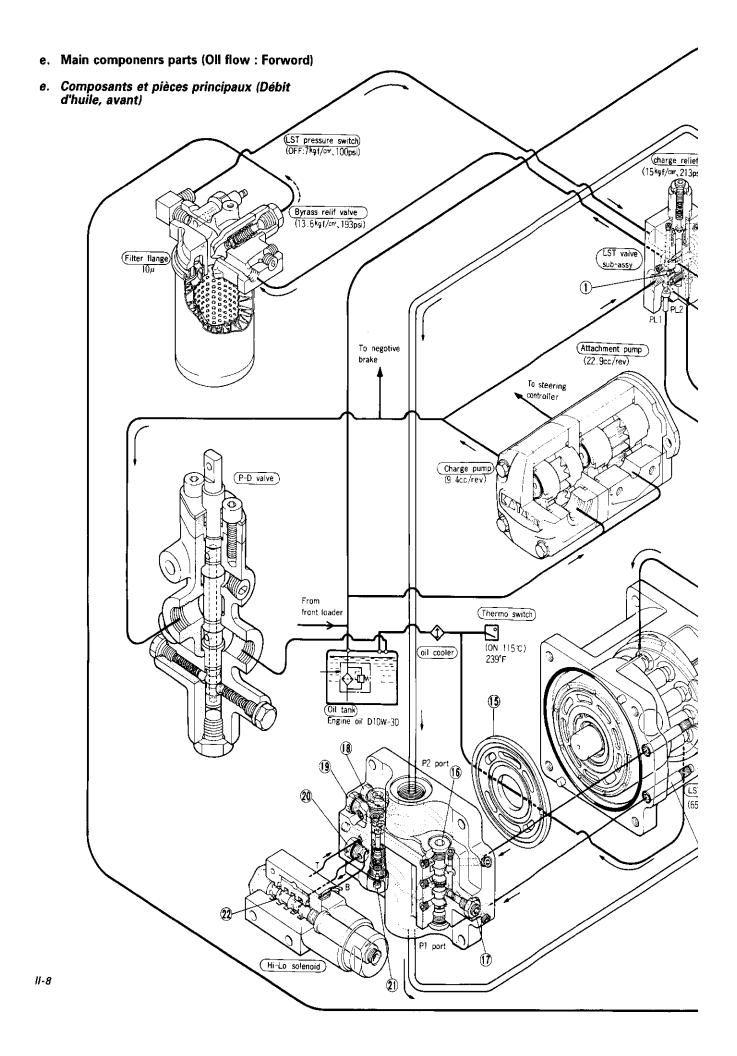
d. Hydraulic circuit Diagram

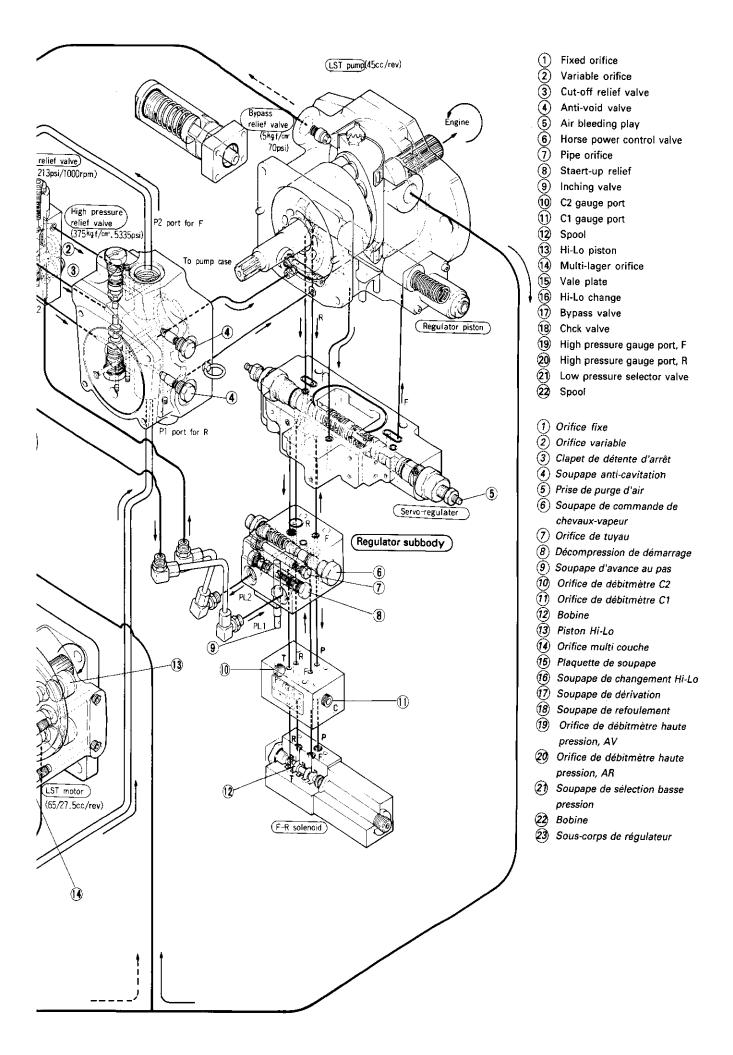
## d. Hydraulic circuit Diagram











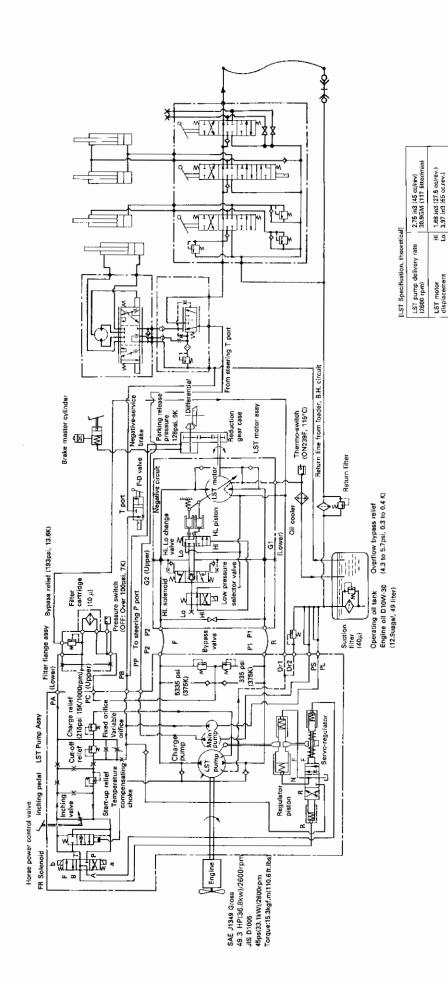
(36/23) × (43/36) × (56 + 13) /13 = 48.375

Power train reduction ratio

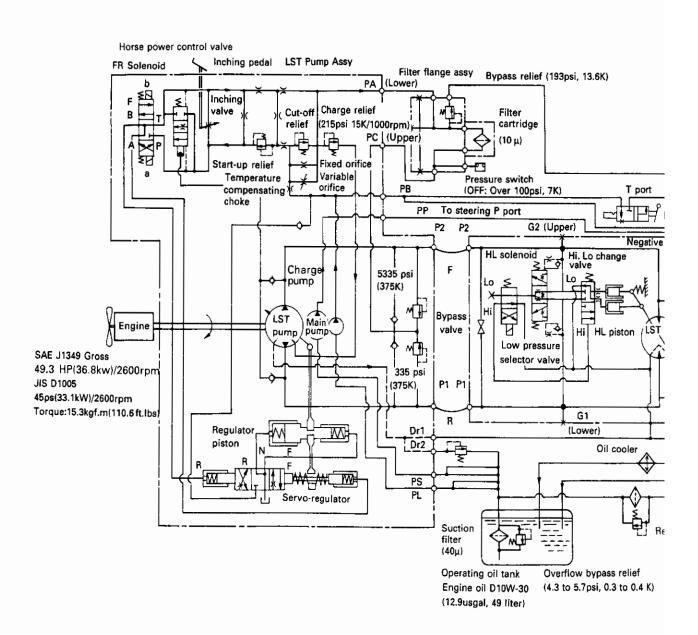
Attachment pump 1.40 in3 (22.9 cc/rev.) delivery rate (2600 rpm) 15.7 GPM (59.54 litter/min)

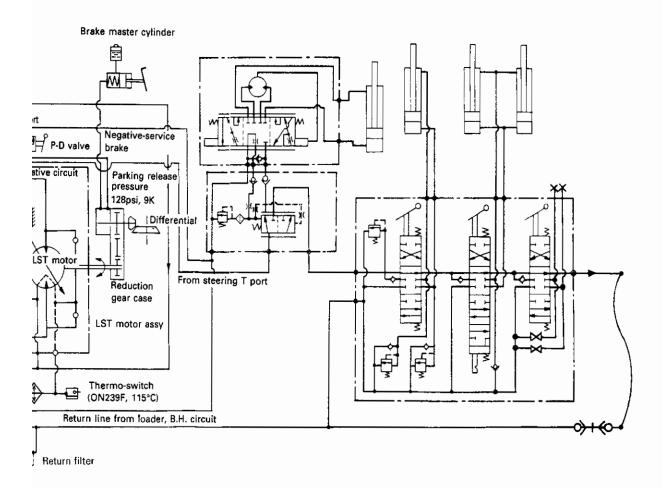
Charge pump delivery 0.43 in3 (7.0 cc/rev.) rate (2600 rpm) 4.81 GPM (18.2 litter/min)

LST motor displacement



### d. Hydraulic circuit Diagram

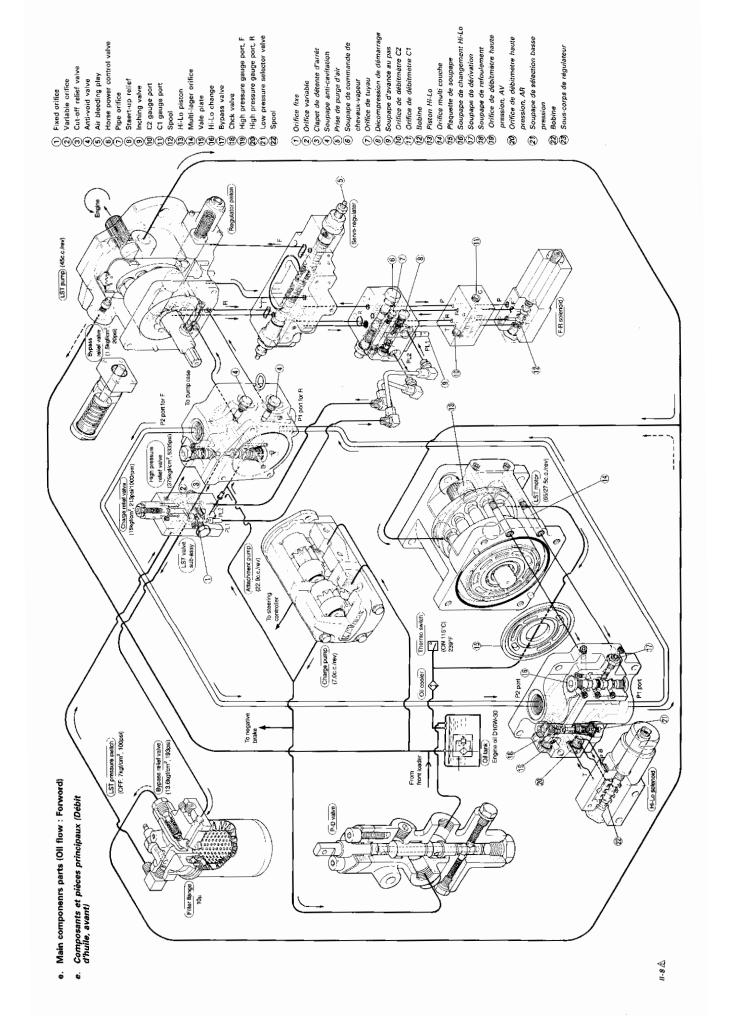


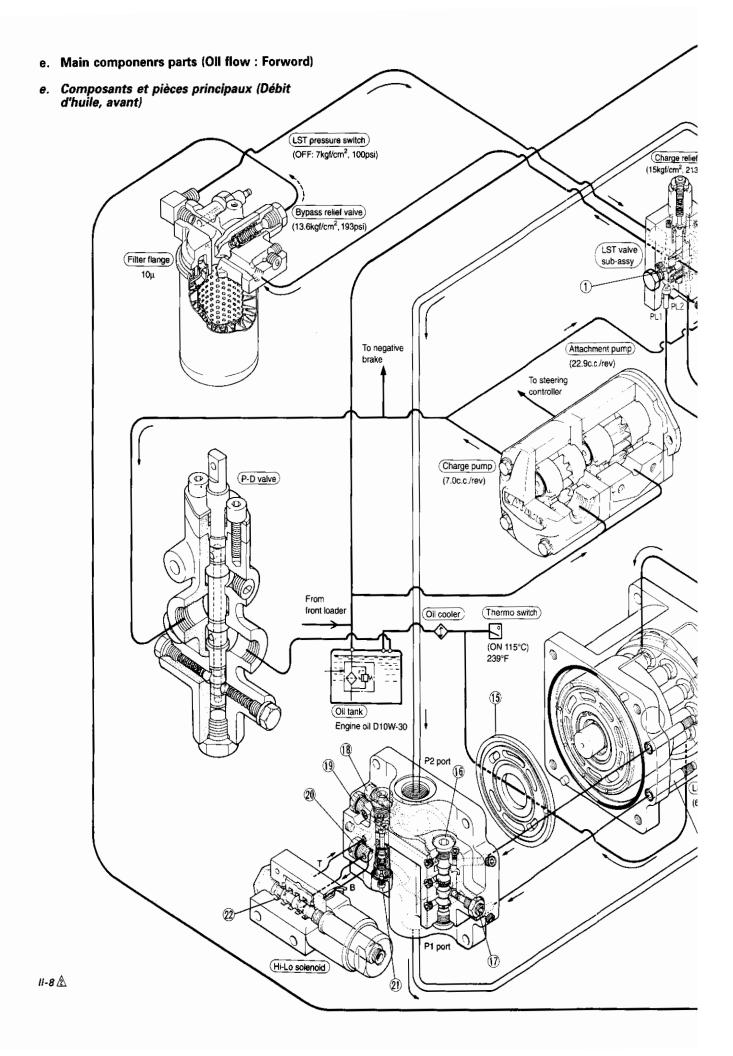


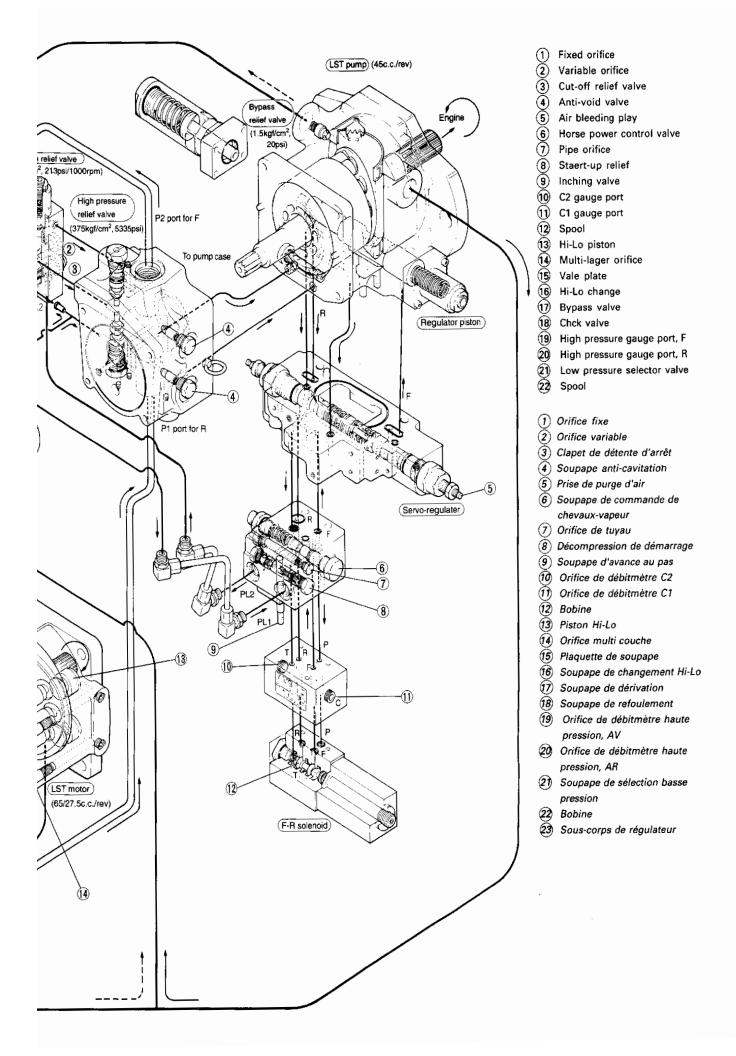
K)

### [LST Specification, theoretical]

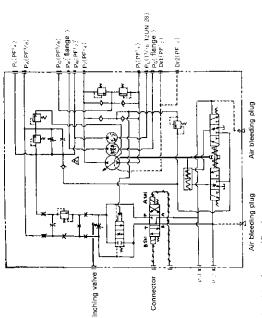
LST pump delivery rate	2.75 in3 (45 cc/rev)		
(2600 rpm)	30.9GM (117 litter/min)		
LST motor Hi	1.68 in3 (27.5 cc/rev.)		
displacement Lo	3.97 in3 (65 cc.rev.)		
Charge pump delivery rate (2600 rpm)	0.43 in3 (7.0 cc/rev.) 4.81 GPM (18.2 litter/min)		
Attachment pump	1.40 in3 (22.9 cc/rev.)		
delivery rate (2600 rpm)	15.7 GPM (59.54 litter/min)		
Power train reduction ratio	(36/23) × (43/36) × (56 + 13) /13 = 48.375		







# f . LST pump, Motor Technical Drawings 1. LST pump (PSVH- 45- CS HS) external drawing



Solenoid valve specification

É	(Hydraunc items)		Ĭ,	(Electrical Items)	
-	Max, oil flow	2.91 usgal/min (118/min) 1. Rated voltage	÷	Rated voltage	12V
ر. ان	Normal operating oil flow	2.64 usgal/min (100/min)	2.	2. Allowable voltage	9~16V
က်	Max. pressure	2490 psi (175 kgf/cm²)	m	3. Consuming current	2.2A below
4	Normal operali pressure	2135 psi (150 kgf/cm²) 4. Coil resistance	4	Coil resistance	5.6Ω (20°C)
lu.	Allowable back pressure	995 psi (70 kgf/cm²)	c,	5. Insulating resistance	5MΩ or more
ø	Ambient temp-range	-4~140°F (-20~60°C)	ø	6. Insulation type	Ē
۲.	Operating oil temp-range	-4~194°F (-20~90°C)	7.	. Water proof	JIS DO 203 SI

LST Pump Specification

dund 1ST		Control items to be follow
Displacement	2.75 in <sup>3</sup> /rev (45 cc/rev)	1. Operating oil: SAE 10W-30 or equivalent
Max. pressure	5335 psi (375 kgf/cm²)	2, Oil temp: -5~194°F (-15~ +90°C)Oil temp. in looped line while relief valve is
Max. speed	3000 rpm	functioning should be with in 230°F (100°C)
Gear pump		3. Contamination level of operating oil within NAS 9 class
Туре	KRP4-23-9C A KRP4-23-7C	(Use nominal 10µ filter)
Max. pressure	2490 psi (175 kgf/cm²)	<ol> <li>No thrust or radial load should be applied on main shaft.</li> </ol>
Max. speed	3000 rpm	<ol> <li>Oit pressure in pump case should be 14.2 psi (1.0 kgf/cm²) or less.</li> </ol>
Displacement	Atrachment:1.40 in³/rev (22.9 co/rev)	<ol><li>Max. pressure of LST pump indicates the effective pressure</li></ol>
	Charge : 0.87 in 3/rev(9.4 totrev)	diferential of P1 and P2

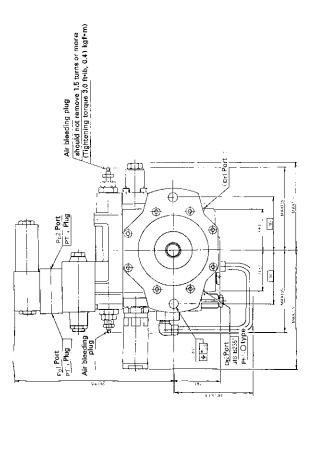
(Note)

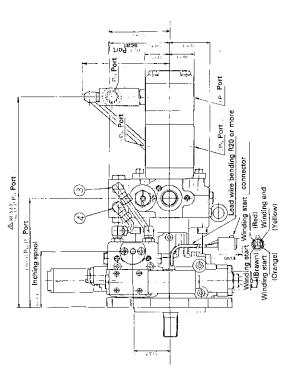
1. Fill LST pump case with operating oif before starting.

2. When installing the coupling flange with pump shaft no shock should be applied.

3. Oil delivery direction: magnetize A solenoid → P¹ port delivery magnetize B solenoid → Pz port delivery

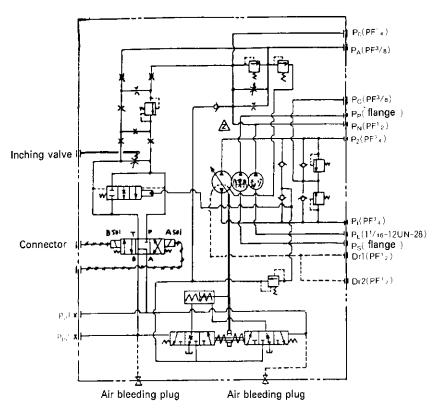
△ LST pump S/N 08A001 ~





# f. LST pump, Motor Technical Drawings

1. LST pump (PSVH- 45- CS HS) external drawing



## Solenoid valve specification

## (Hydraulic items)

#### (Electrical items)

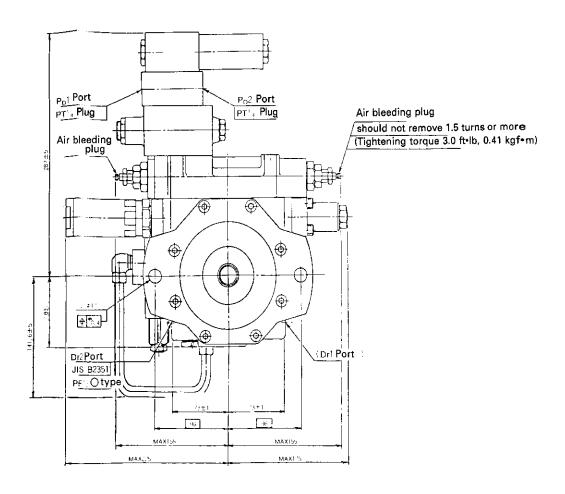
1.	Max. oil flow	2.91 usgal/min (112/min)	1.	Rated voltage	12V
2.	Normal operating oil flow	2.64 usgal/min (10l/min)	2.	Allowable voltage	9~16V
3.	Max. pressure	2490 psi (175 kgf/cm²)	3.	Consuming current	2.2A below
4.	Normal operali pressure	2135 psi (150 kgf/cm²)	4.	Coil resistance	5.6Ω (20°C)
5.	Allowable back pressure	995 psi (70 kgf/cm²)	5.	Insulating resistance	5MΩ or more
6.	Ambient temp-range	-4~140°F (-20~60°C)	6.	Insulation type	E
7.	Operating oil temp-range	-4~194°F (-20~90°C)	7.	Water proof	JIS DO 203 SI

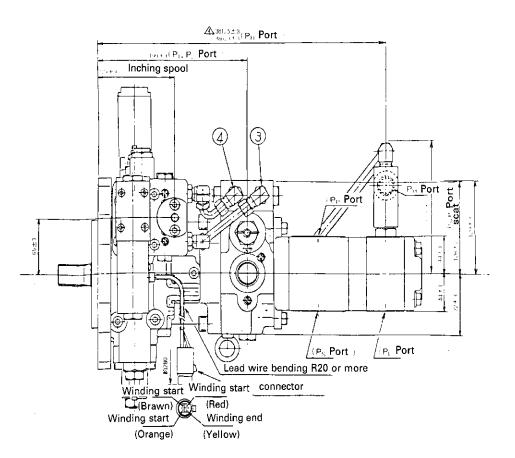
# LST Pump Specification

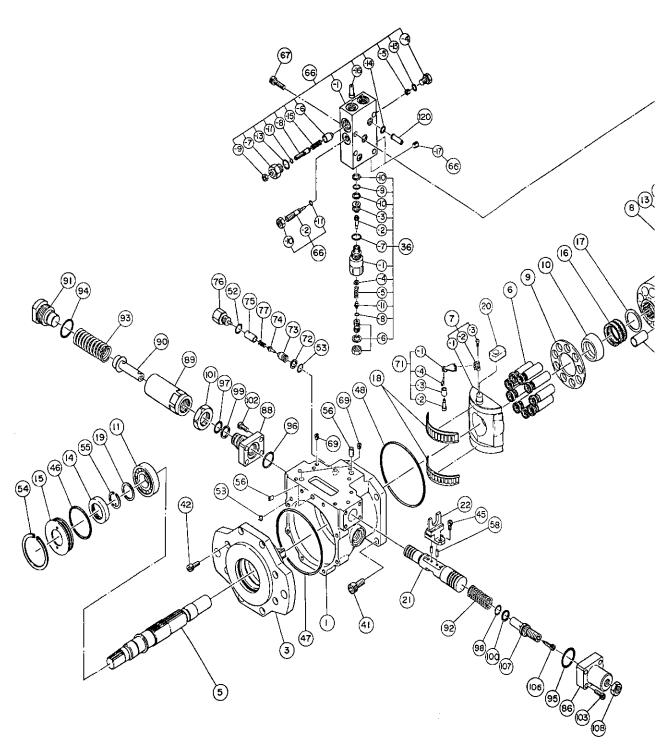
LST pump				Control items to be follow
Displacement	2.75 in <sup>3</sup> /rev (	45 cc/rev)	1.	Operating oil: SAE 10W-30 or equivalent
Max. pressure 5335 psi (375 kgf/cm²)		5 kgf/cm²)	2.	Oil temp: -5~194°F (-15~ +90°C)Oil temp. in looped line while relief valve is
Max. speed 3000 rpm			<b>1</b>   	functioning should be with in 230°F (100°C)
Gear pump			3.	Contamination level of operating oil within NAS 9 class
Туре	KRP4-23-9C			(Use nominal 10μ filter)
Max. pressure	2490 psi (175 kgf/cm²)		4.	No thrust or radial load should be applied on main shaft.
Max. speed	3000 r	pm	5.	Oil pressure in pump case should be 14.2 psi (1.0 kgf/cm²) or less.
Displacement	Attachment:1.40 in <sup>9</sup> /rev (22.9 cc/rev)		6.	Max. pressure of LST pump indicates the effective pressure
	Charge: 0.57 in 3/rev(9.4 cc/rev)	Charge : 0.57 in <sup>3</sup> /rev(9.4 cc/rev)		diferential of P1 and P2

# (Note)

- 1. Fill LST pump case with operating oil before starting.
- 2. When installing the coupling flange with pump shaft, no shock should be applied.
- 3. Oil delivery direction: magnetize A solenoid  $\rightarrow$  P1 port delivery

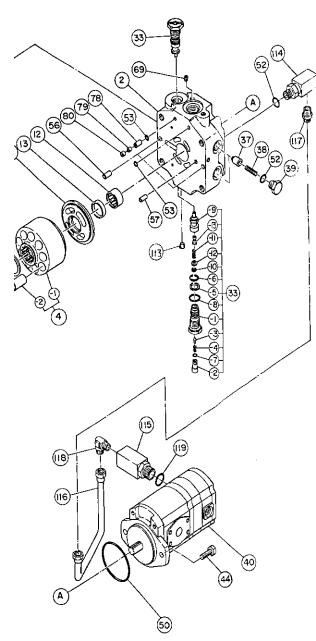






Part No.	Tightening torque ft-lb (kgf.m)
3	144.7 ~ 166.4 (20 ~ 23)
7-3	
33-1	86.8 ± 4.3 (12 ± 0.6)
36-1	57.9 ~ 65.1 (8 ~ 9)
36-6	21.7 ~ 28.9 (3 ~ 4)
39	37.6 ± 1.4 (5.2 ± 0.2)

Part No.	Tightening torque ft-lb (kgf.m)
41	
42	23.9 ± 1.4 (3.3 ± 0.2)
44	32.5 ± 1.7 (4.5 ± 0.23)
45	
66-7	28.9 ± 1.4 (4 ± 0.2)
66-9	2.97 ± 1.4 (0.41 ± 0.2)
67	23.9 ± 1.4 (3.3 ± 0.2)



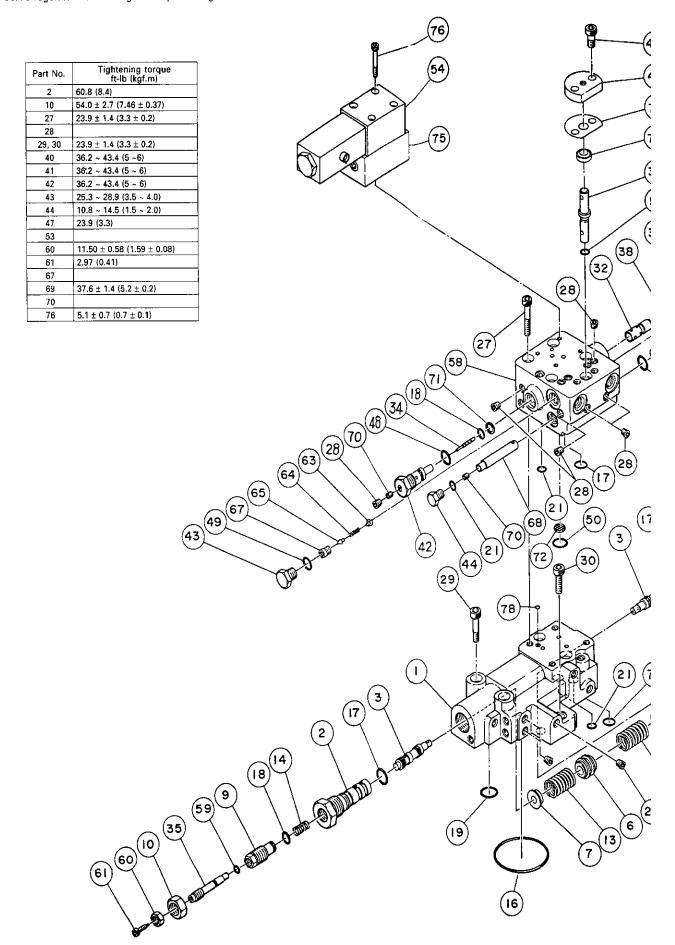
	No.	Name	pcs.
	1	LST pump case	1
	2	Port block	1
	3	Flange	1
	4	Cylinder block assy	1
	5	Shaft	1
	6	Piston assy	9
	.7	Swash plate assy	1
	8	Valve plate	1
	9	Retainer plate	1
	10	Retarner holder	1
	11	Roller bearing	1
Ì	12	Needle bearing	1
	13	Collar	1
	14	Oil seal	1
		Oil seal case	1
	16	Bellbil soring assy	<del></del>
	17	Washer	1
	18 19	Bearing Spacer	1
		Spacer Slide metal	
	20	Slide metal	1
	21	Regulator piston	-
	23	Stay Valve accv	2
	33-1	Valve assy	2
		Valve body	2
	33-2 33-3	Set screw	2
	33-3	Poppet	2
	-	Spring	2
	33-5 33-6	Backup ring	2
	33-7	O-ring	2
	-	O-ring	2
	33-8 33-9	O-ring Pagnet	2
	33-10	Poppet Filter	2
	33-10		2
	33-11	Spring Collar	2
		Orifice	2
	36	Relief sub-assy	1
	36-1	Relief housing	1
	36-2	Poppet	1
	36-3	Poppet seat	1
	36-4	Spring seat	1
	36-5	Spring	i i
	36-6	Adjuster kit	1
	36-7	O-ring	1
	36-8	0-ring	1
	36-9	0-ring	1
	36-10		2
	36-11	Spring guide	1
	37	Poppet	2
	38	Spring	2
	39	Plug (PF 3/8)	2
	40	Gear pump	1
	41	Socket head bolt (M12-30L)	2
	42	Socket head bolt (M 8-18L)	8
	44	Bolt (M10-25)	2
	45	Socket head bolt (M8-18L)	2
	46	O-ring	1
	47	O-ring	1
	48	O-ring	1
	50	O-ring	1
	52	O-ring	4
	53	O-ring	4
	54	Snap ring	1
	55	Snap ring	1
	56	Pin	5
	-	Pin	1
	57		
	57 58	Pin	2

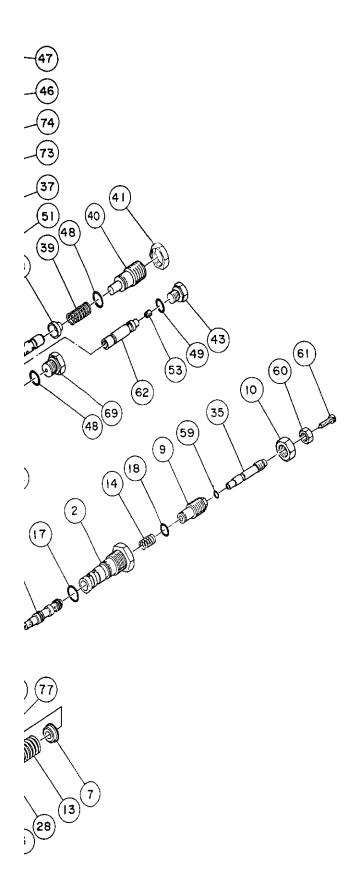
No.	Name	pcs.
66	LST valve subassy	1
66-1	Body	1
66-2	Valve	1
66-4	Plug (PF3/8)	1
66-5	Orifice	1
66-6	Poppet	1
66-7	Plug	1
66-8	Adjuster	1
66-9	Nut (M6)	1
6-10	Nut (M10)	1
6-11	O-ring	2
6-13	O-ring	2
6-14	O-ring	3
6-15		1
	Spring	2
6-16 6-17	Choke Plug ()F 1/8)	2
67		4
	Socket head bolt (M8-45L)	
69	Plug	10
71	Guide gear assy	2
72	Backup ring	1
73	Bushing	1
74	Spool	1
75	Collor	1
76	Plug	1_
77	Spring	1 1
78	Check seat	1
79	Poppet	1 1
80	Stopper	1
86	Сар	1
88	Сар	1_
89	Adjuster	1
90	Spring seat	1_
91	Plug	1
92	Spring	1_
93	Spring	1
94	O-ring	1
95	O-ring	1
96	O-ring	1
97	O-ring	1
98	0-ring	1
99	Backup ring	11
100	Backup ring	1
101	Nut	1
102	Socket head bolt (M8-16L)	4
103	Socket head bolt (M8-30L)	4
106	Plug	1
107	Stopper	1
108	Nut	1
113	Plug	1
114	Fitting subassy (A)	1
115	Fitting subassy (B)	1
116	Pipe	1
117	Connector	1
118	L-bow	1
119	O-ring	1
	Choke	1 1
120		

Part No.	Tightening torque ft-lb (kgf.m)
67	23.9 ± 1.4 (3.3 ± 0.2)
69	
76	28.9 ± 1.4 (4.0 ± 0.2)
101	202.5 ~ 217.0 (28 ~ 30)
102	23.9 ± 1.4 (3.3 ± 0.2)
108	72.3 ± 14.5 (10 ± 2)
116	21.7 ~ 28.9 (3.04 ~ 4.0)

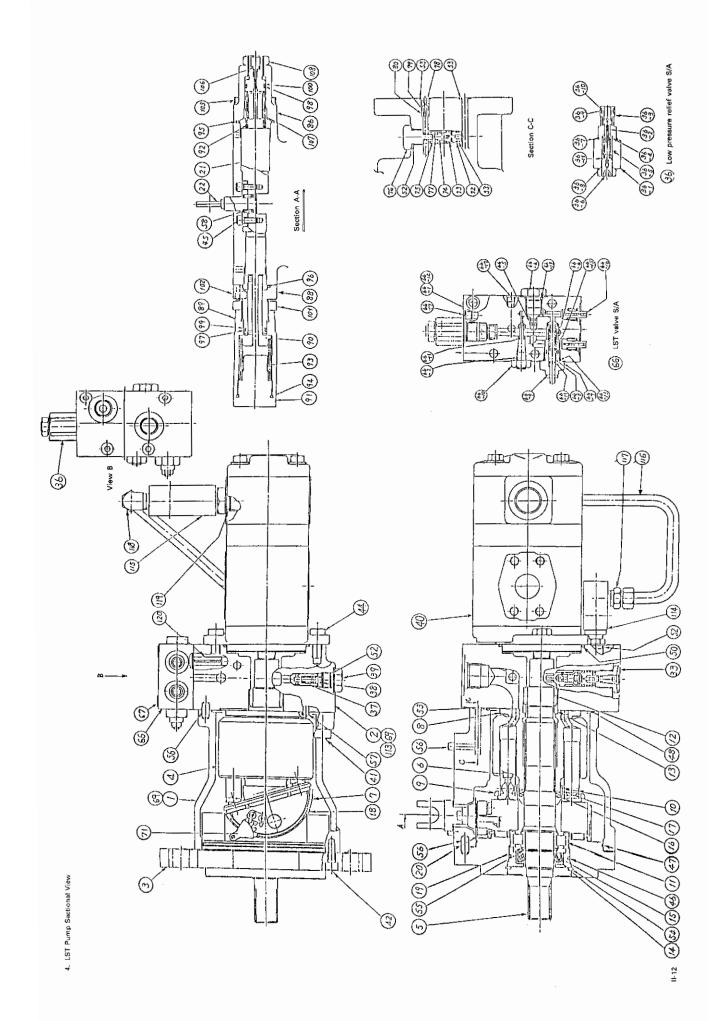
(9)			
(3) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4			
	2 (48 (68) (82) (83) (83) (83) (83) (83) (83) (83) (83	(F)	
			(Z) (3) (E) (Z) (Z) (Z) (Z) (Z) (Z) (Z) (Z) (Z) (Z
			<b>(a)</b>
	(4) (4) (4) (4) (4) (4) (4) (4) (4) (4)	(A)	
	(43) (65) (65)	( <u>m</u> )	
Tightening torque H-bb (kgf/m) (50.8 (8.4) (kgf/m) (50.8 (8.4) (50.2) (7.0 (4.5.0.2) (50.2) (4.4.6 (5.6) (50.2) (5			(6) (63.5)
Pert No. 1			

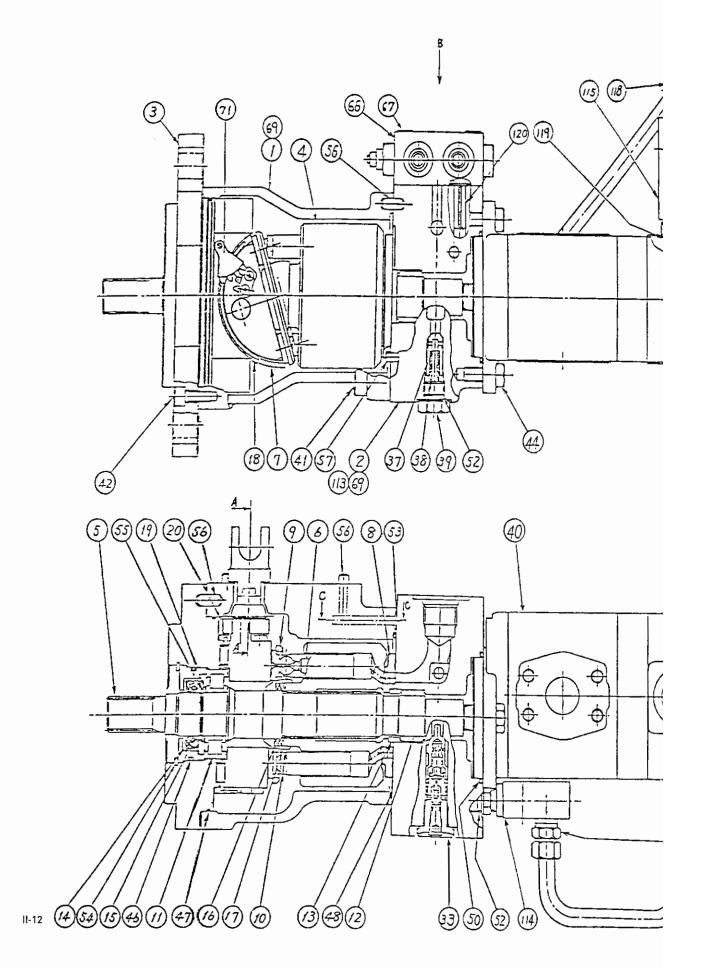
3. Servo-regulator Assembling Development Figure

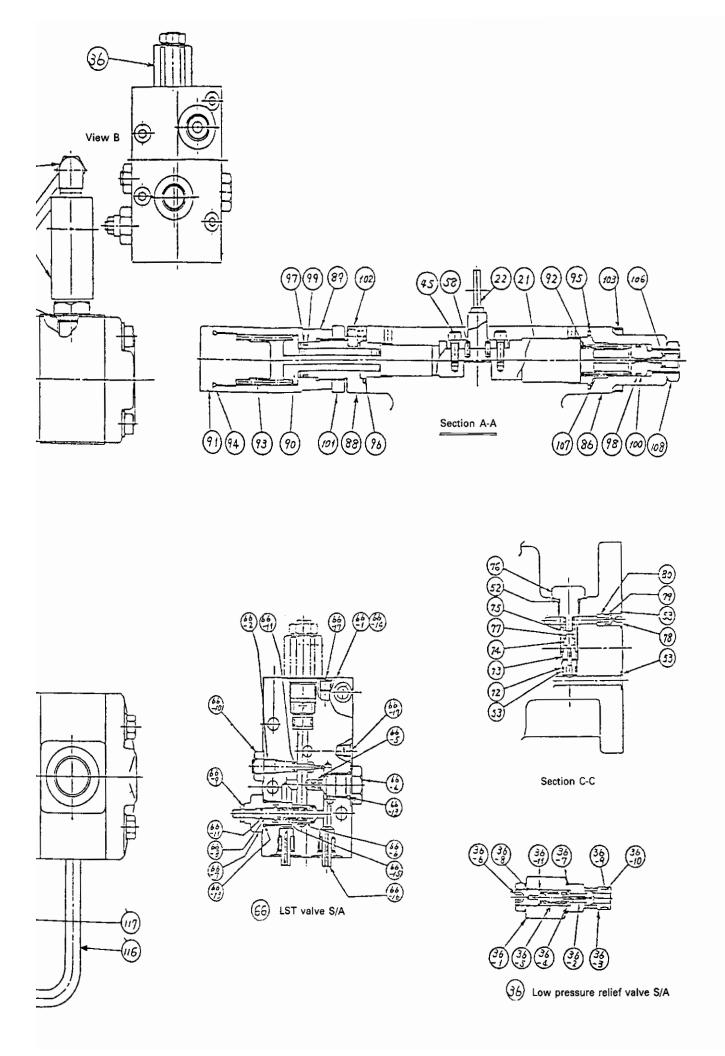


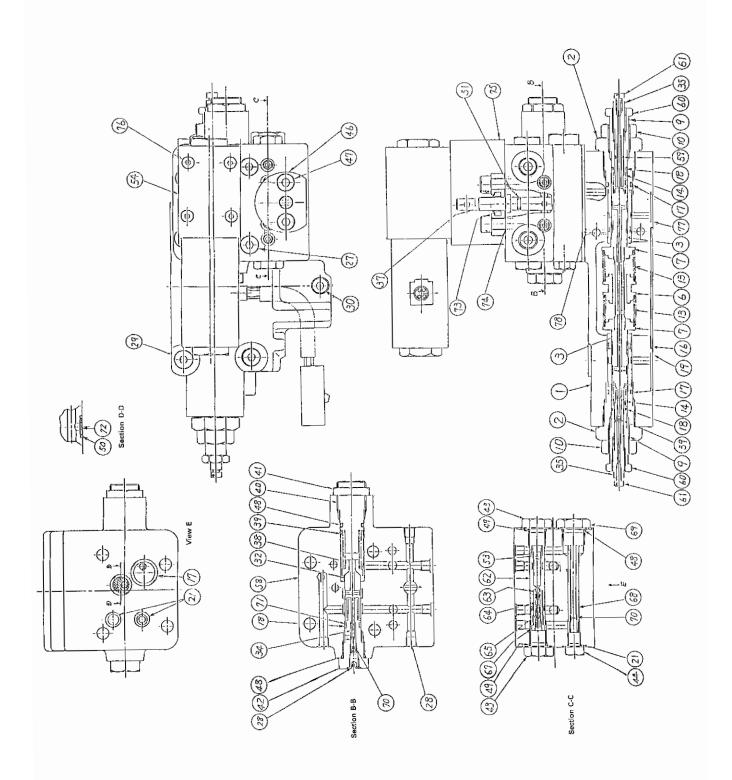


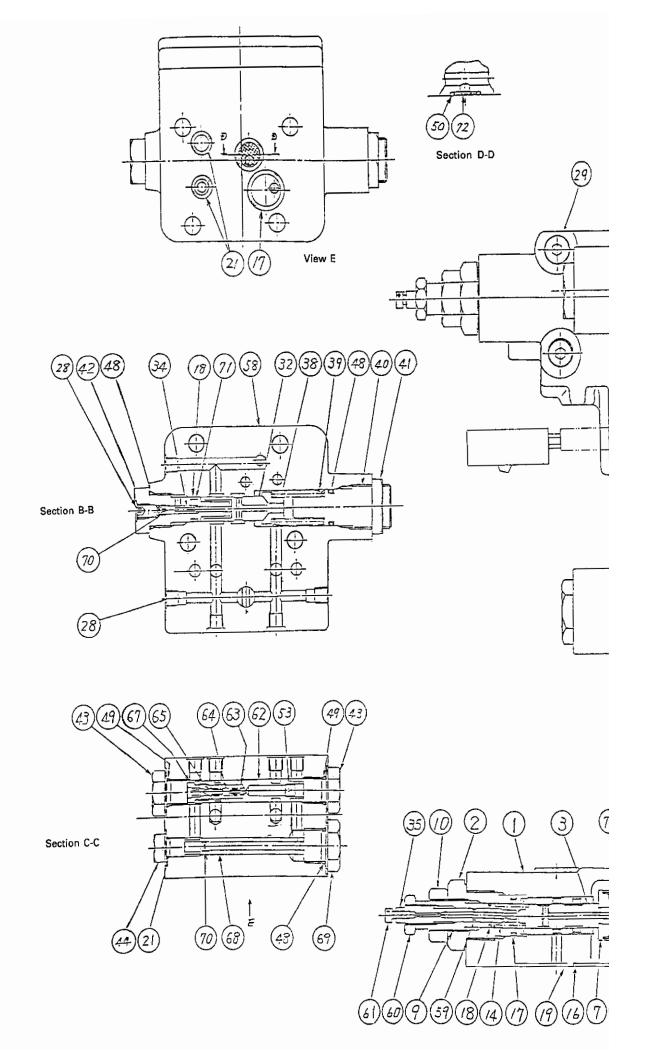
No.	Name	pcs.
1	Body	. 1
2	Sleeve	2
3	Spool	2
6	Spring seat	1
7	Spring seat	2
9	Plug	2
10	Nut (M16)	2
13	Spring	2
14		2
$\overline{}$	Springt	1
16	O-ring	3
17	0-ring	_
18	O-ring	3
19	O-ring	1
21	O-ring	6
27	Socket head bolt (M8-60L)	4
28	Plyg	23
29	Socket head bolt (M8-50L)	4
30	Socket head bolt (M8-25L)	1_
32	Spool	1
34	Rod	1
35	Stopper	2
37	Spool	1_
38	Spring seat	1
39	Spring	1
40	Plug	1
41	Nut	1
42	Plug	1
43	Plug (PF1/4)	2
44	Plug (PF1/8)	1
46	Plate	1
47	Socket head bolt (M8-20L)	2
48	O-ring	3
49		2
	O-ring	1
50	O-ring	1
51	O-ring	
53	Orifice	1
54	Solenoid valve	1
58	Sub body	1
59	O-ring	22
60	Nut (M10)	22
61	Plug	22
62	Bush ofrifice	1
63	Spring seat	1 1
64	Spring	1
65	Poppet	1
67	Valve seat	1
68	Pipe	1
69	Plug (PF 3/8)	1
70	Orifice	2
71	Backup ring	1
72	Filter	1
73	Dust seal	1
74	Packing	1
75	Pickup plate	+ †
76	Socket head bolt	4
77	<del></del>	1
	O-ring	1
78	O-ring	

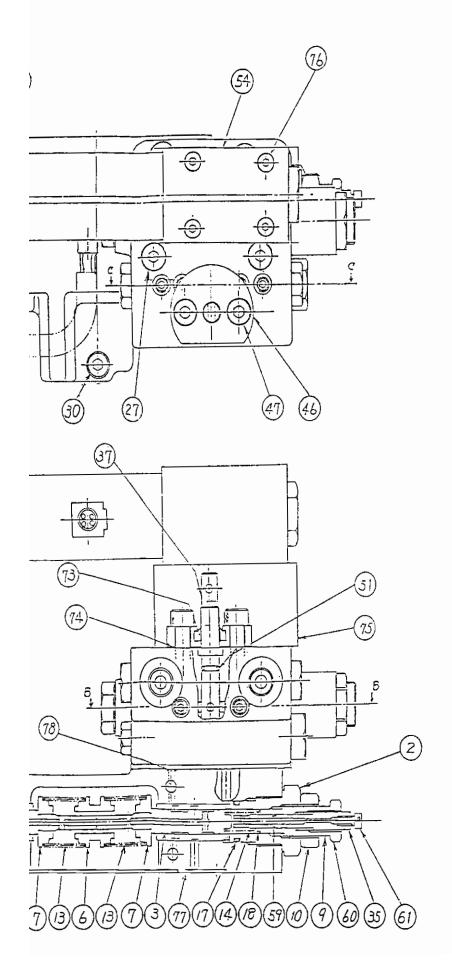


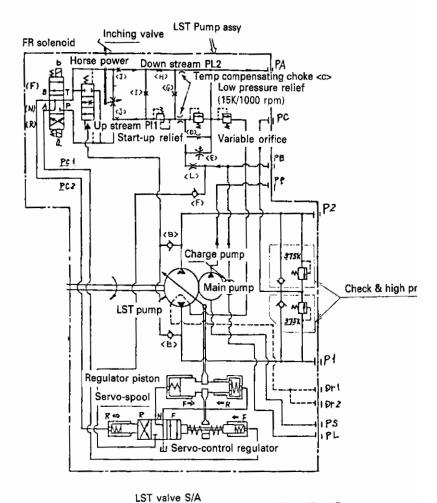


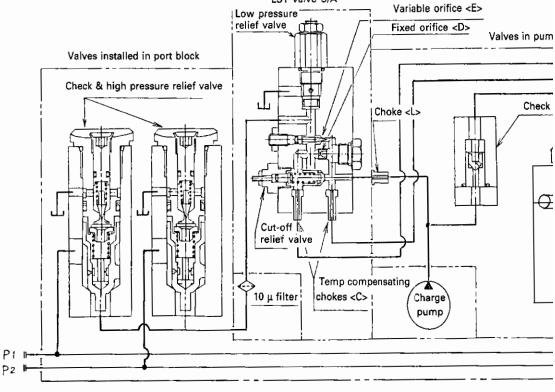


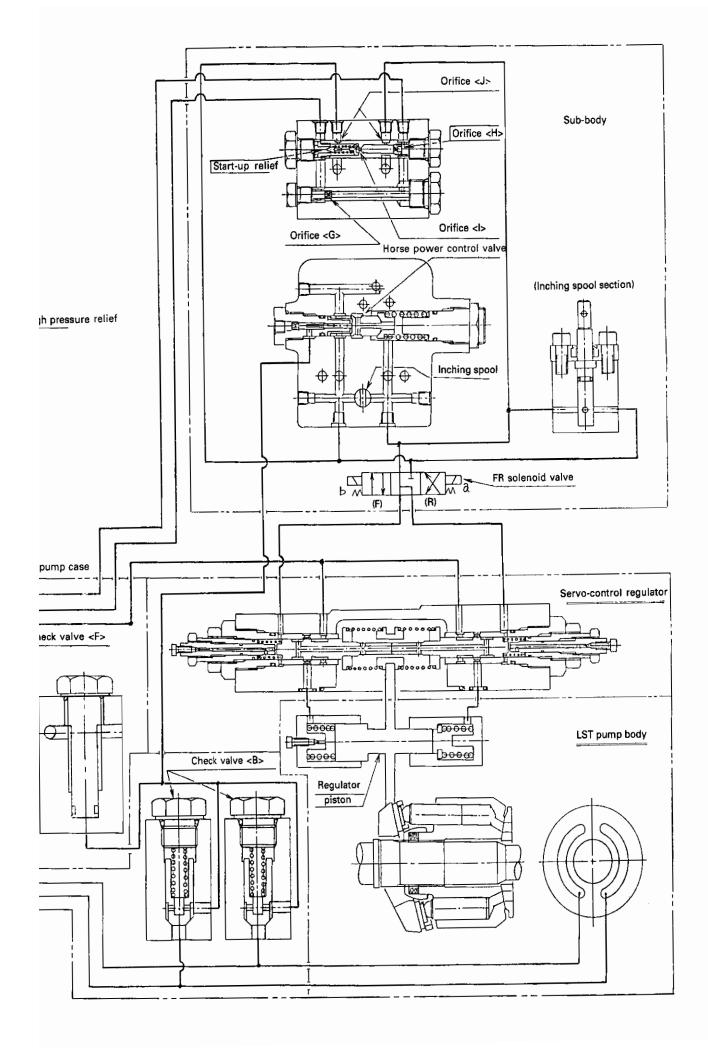






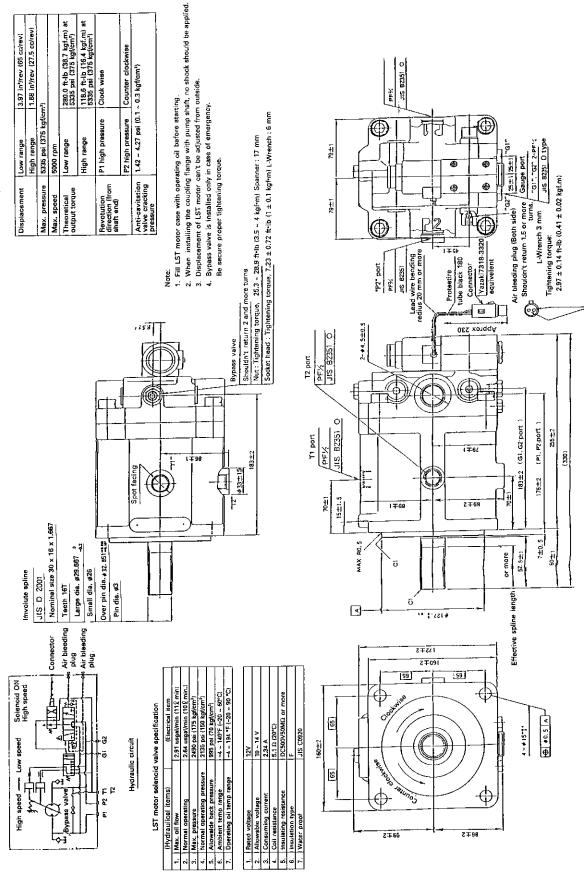


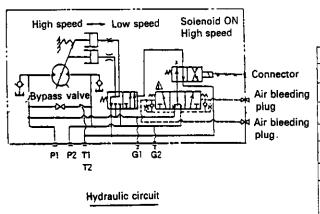




Lead wire connecting position

LST motor Specification 6. LST motor external drawing

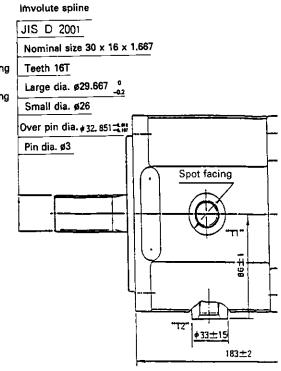


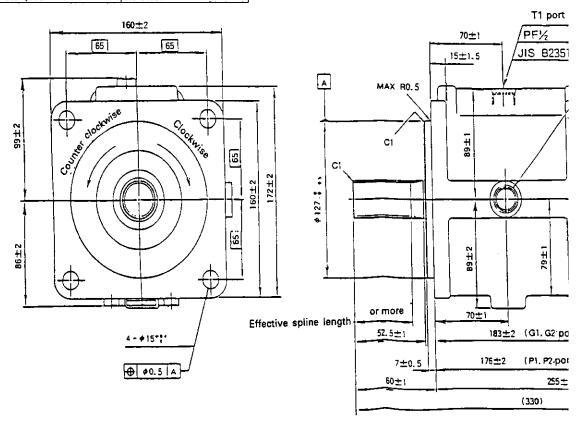


#### LST motor solenoid valve specification

	(Hydraulical items)	(Electrical item
1.	Max. oil flow	2.91 usgal/min (11½ min)
2.	Normal operating	2.64 usgal/min (10 € min.)
3.	Max. pressure	2490 psi (175 kgf/cm²)
4.	Normal operating pressure	2135 psi (150 kgf/cm²)
5.	Allowalde back pressure	995 psi (70 kgf/cm²)
6.	Ambient temp range	-4 ~ 140°F (-20 ~ 60°C)
7.	Operating oil temp range	-4 - 194 "F (-20 - 90 °C)

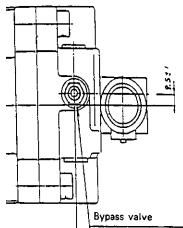
1.	Rated voltage	12V
2.	Allowable voltage	10 ~ 14 V
3.	Consuming current	2.34 A
4.	Coil resistance	5.1 Ω (20°C)
5.	Insulating resistance	DC500V50MΩ or more
6.	Insulation type	F
7.	Water proof	JIS C0920





#### LST motor Specification

Displacement	Low range	3.97 in <sup>3</sup> /rev (65 cc/rev)
	High range	1.68 in³/rev (27.5 cc/rev)
Max. pressure	5335 psi (375 kgf/c	m²)
Max. speed	5000 rpm	
Theoretical output torque	Low range	280.0 ft-lb (38.7 kgf.m) at 5335 psi (375 kgf/cm²)
	High range	118.6 ft-lb (16.4 kgf.m) at 5335 psi (375 kgf/cm²)
Revotution direction (from shaft end)	P1 high pressure	Clock wise
	P2 high pressure	Counter clockwise
Anti-cavitation valve cracking pressure	1.42 ~ 4.27 psi (0.1 ~ 0.3 kgf/cm²)	



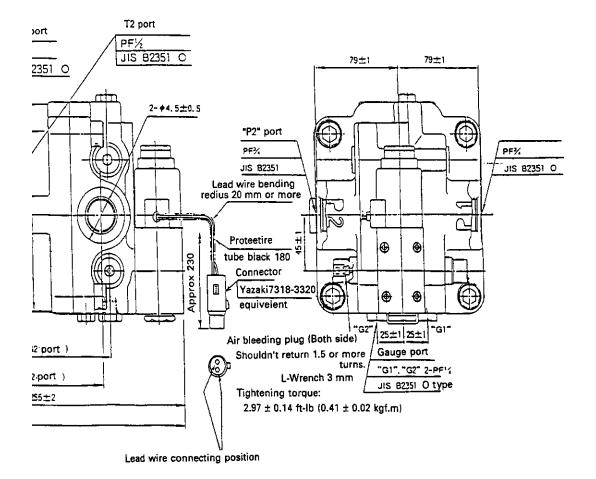
#### Note:

- 1. Fill LST motor case with operating oil bafore starting.
- 2. When installing the coupling flange with pump shaft, no shock should be applied.
- 3. Displacement of LST motor can't be adjusted from outside.
- Bypass valve is installed only in case of emergency.
   Be secure proper tightening torque.

Shouldn't return 2 and more turns

Nut : Tightening torque, 25.3 ~ 28.9 ft-lb (3.5 ~ 4 kgf-m) Spanner : 17 mm

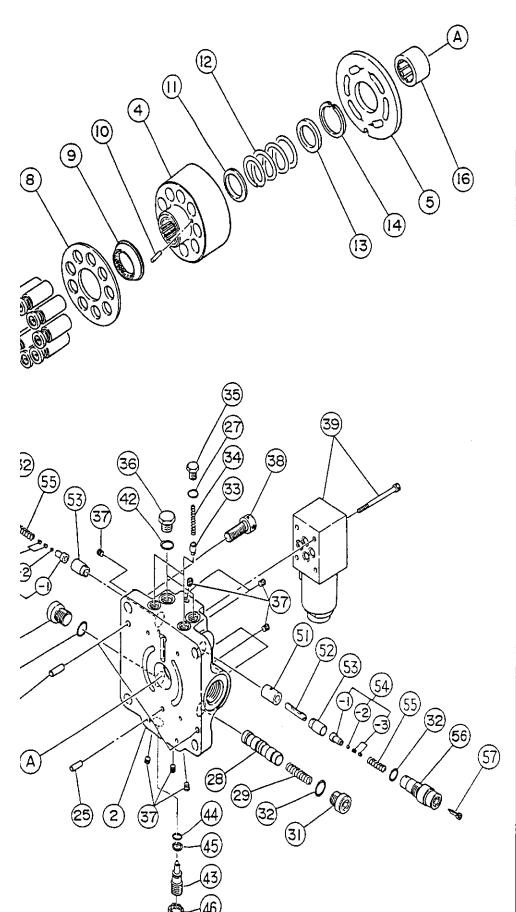
Socket head : Tightening torque,  $7.23 \pm 0.72$  ft·lb (1  $\pm$  0.1 kgf·m) L-Wrench : 6 mm



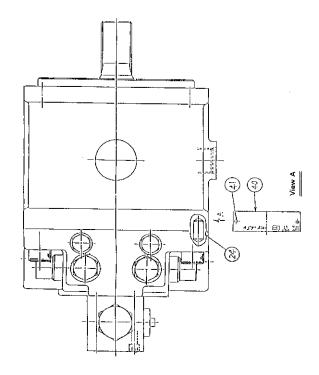
Plug Socket head bolt (M14-35L) Solenoid valve Name plate Screw **@** (8) (a) **4** (b) (%) (8) (3) (g)4 4 4 **(a)** 000 4 (B) (B) (v) **@** 33 (33) (D) (2) (**®**) ➂ (8) (8) (Z) (B) (E) (F) (M) **(F)** 9 (3) (1) **P 4** (w) **(P)** (8) (0) (3) (N) <u>(4</u>) **(** (<del>4</del>) 8 (3) (8)

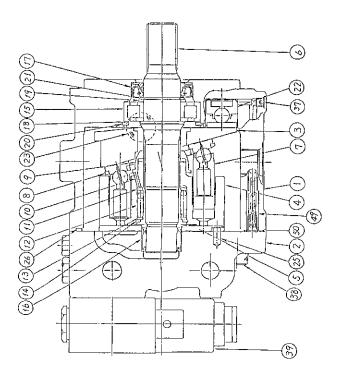
7. LST Motor Assembling Development Figure

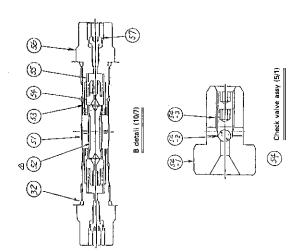
Part No.	Tightening torque ft-lb (kgf.m)	
1	91.1 ~ 108.5 (12.6 ~ 15.0)	
29	5.06 ± 0.72 (0.7 ± 0.1)	
31	39.8 ± 3.6 (5.5 ± 0.5)	
35	12.7 ± 1.8 (1.75 ± 0.25)	
38	130.2 ± 21.7 (18 ± 3)	
43	7.2 ± 0.7 (1 ± 0.1) ,	6
46	27.1 ± 1.8 (3.75 ± 0.25)	8
56	39.8 ± 3.6 (5.5 ± 0.5)	
57	2.97 ± 0.14 (0.14 ± 0.02)	(7)
	22	(7) (8) (8) (8) (8) (9) (9) (9) (9) (9) (9) (9) (9) (9) (9

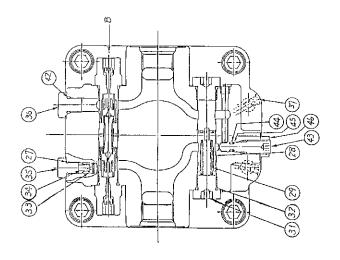


No.	Name	pcs.
1	LST motor case	1
2	Port block	1
3	Swash plate	1
4	Cylinder block	1
5	Valve plate	1
6	Shaft	1
7	Piston assy	9
8	Retainer plate	1
9	Retainer holder	1
10	Pin	10
11	Collor	1
12	Spring	1
13	Collor	1
14	Snap ring	1
15	Bearing	1
16	Needle bearing	1
17	Oil seal	1
18	Spacer	1
19		1
20	Spacer Span ring	1
_	Snap ring	_
21	Snap ring	1
22	Piston assy	2
23	Steel ball	2
24	Pin	2
25	Pin	1
_ 26	O-ring	1
27	O-ring	2
28	Spool	1
29	Spring	1
31	Plug	2
32	0-ring	4
33	Poppet	2
34	Spring	2
35	Plug	2
36	Plug	2
37	Plug	13
38	Socket head bolt (M14-35L)	4
39	Solenoid valve	1
40	Name plate	1
41	Screw	2
42	O-ring	2
43	Valve	1
44	O-ring	1
45	Back up ring	1
46	Nut	1
49	Orifice plug assy	2
50	O-ring	2
51	Bush	1
52	Spool	1
53	Bush	2
54	Check valve assy	2
54-1	Check seat	1
54-2	Steel ball	1
54-3	Set screw	2
55	Spring	2
56	Plug	2
57	plug	2
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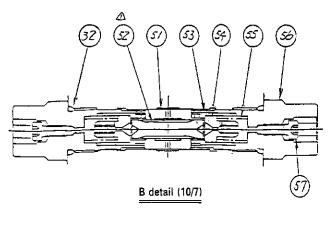


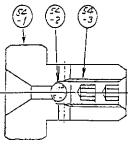




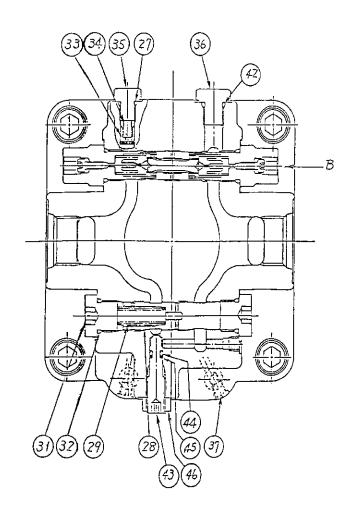
8. LST Moter Sectional View

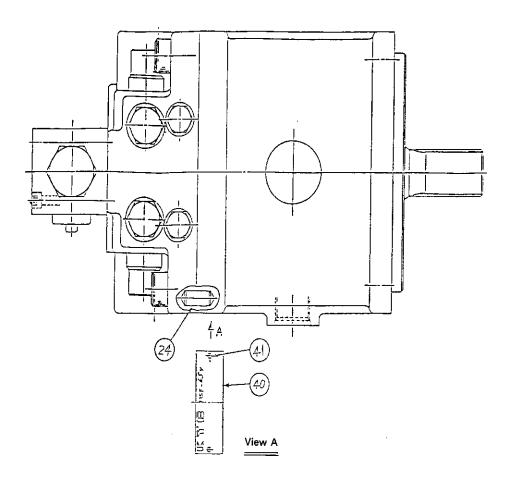
# 8. LST Moter Sectional View

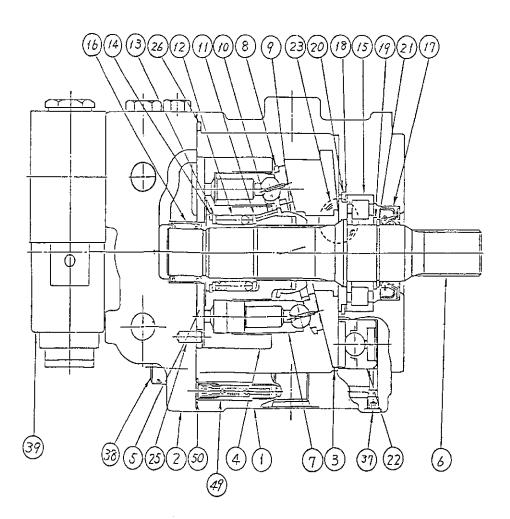




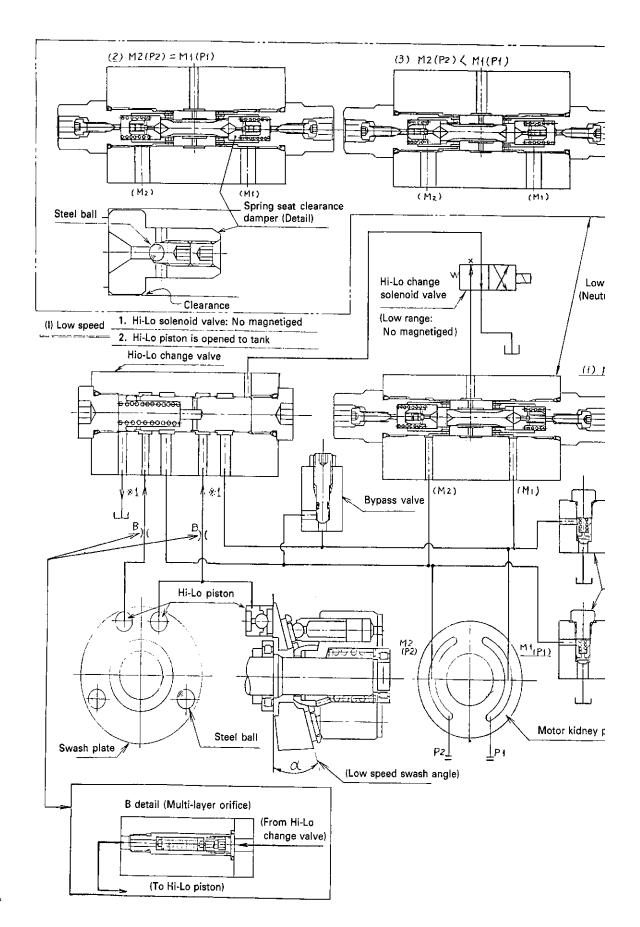
Check valve assy (5/1)

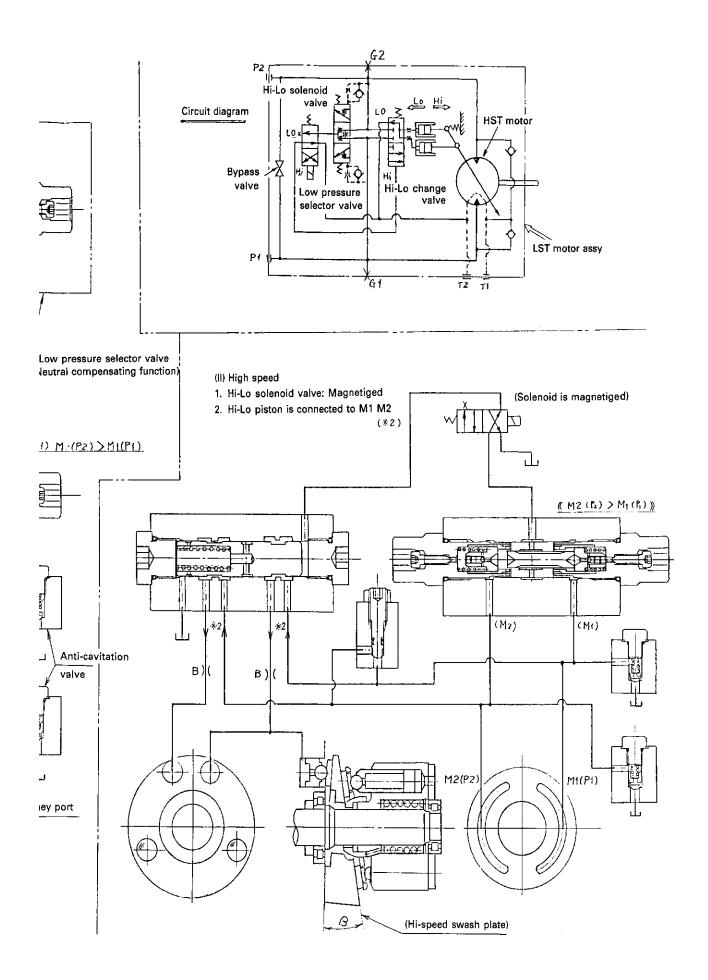






9. LST Motor Functional Chart (MSF-65V)





20-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-		90	00 43	÷e		2			000				
		Ref. Fig	-	2	ю	4	un.	9	7	ω	on c	69	
	following pages.	Remedy	Retighten with seal tape.	Remove and clean.	Tighten to torque. Renew O-ring.	Retightening.	Retightening.	Check pipe seat and change pipe	Check pipe seat and change pipe.	Remove, clean and retighten.	Remove, clean and retighten.	Replace with new cartridge.	
	Below table is for your quick reference on what have been occurred in the past and taken the countermeasure. When you encounter the specific trouble case except these examples, refer to the troubleshooting flow chart listed in the following pages.	Cause	Laosening or improper tighiening.	Dust intruded into O-ring when assembling.	Improper tightening and O-ring came off.	Improper tighteming of hose band.		Improper tightning of pipe nut.	Improper pipe seat mating.	Roreign material intruded at poppet surface of charge relief valve (Low pressure relief valve.)	Foreign material intruded at poppet surface of bypass relief valve in filter flange.	iii) 10 µ filter certridge clogged with contamination.	
B. Troubleshooting a. Quick reference chart	Below table is for your quick reference on what have been occurred in the past and taken the countermeasure. When you encounter the specific trouble case except these examples, refer to the traubleshooting flow chart lit	Symptom	From LST motor plug.	(Refer to page From regulator piston stopper.	From LST pump sub-body mating surface.	From low-pressure hose connecting with oil cooler.	From LST motor case oil return hose. Improper tighteming of hose band.	From LST charge pump pipe.	From Loader control valve return pipe.	2. LST charge pressure warning lamp lights up.			

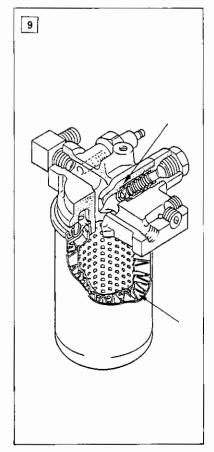
# **B.** Troubleshooting

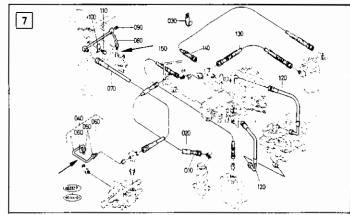
# a. Quick reference chart

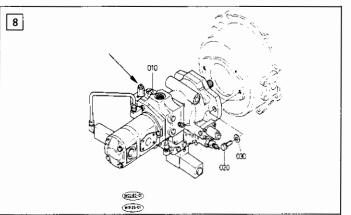
Below table is for your quick reference on what have been occurred in the past and taken the countermeasure.

When you encounter the specific trouble case except these examples, refer to the troubleshooting flow chart listed in the following pages.

		Symptom	Cause	
1.	Oil leaks	From LST motor plug.	Loosening or improper tighiening.	Retighten with sea
	(Refer to page	From regulator piston stopper.	Dust intruded into O-ring when assembling.	Remove and clean.
	for specific tightning torque.)	From LST pump sub-body mating surface.	Improper tightening and O-ring came off.	Tighten to torque.
	torque.)	From low-pressure hose connecting with oil cooler.	Improper tighteming of hose band.	Retightening.
		From LST motor case oil return hose.	Improper tighteming of hose band.	Retightening.
		From LST charge pump pipe.	Improper tightning of pipe nut.	Check pipe seat an
		From Loader control valve return pipe.	Improper pipe seat mating.	Check pipe seat an
2.	2. LST charge pressure warning lamp lights up.		Foreign material intruded at poppet surface of charge relief valve (Low pressure relief valve.)	Remove, clean and
			ii) Foreign material intruded at poppet surface of bypass relief valve in filter flange.	Remove, clean and
			iii) 10 μ filter cartridge clogged with contamination.	Replace with new





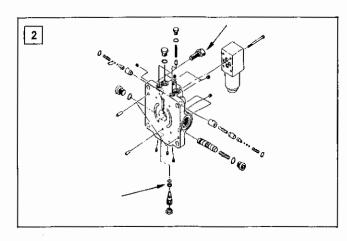


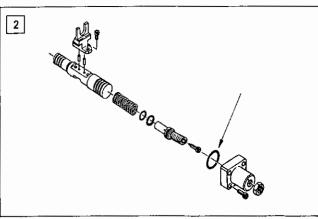


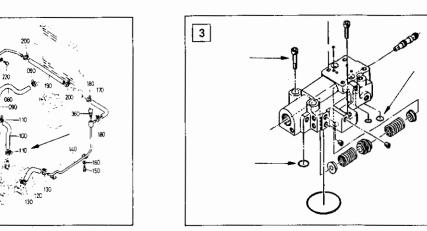
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S

Remedy	Ref. Fig
seal tape.	1
ean.	2
ue. Renew O-ring.	3
	4
	5
t and change pipe	6
t and change pipe.	7
and retighten.	8
and retighten.	9
new cartridge.	9







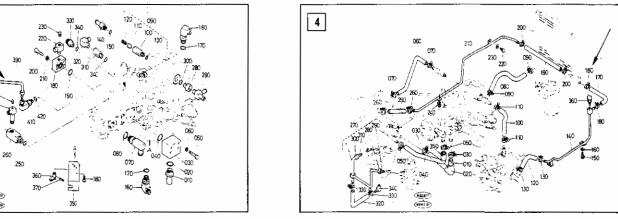
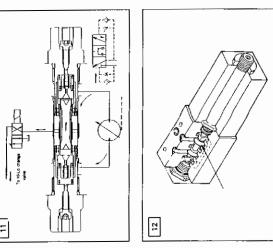
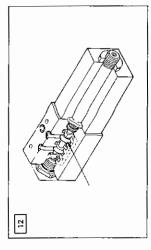


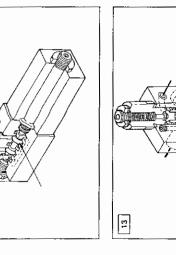
Fig	10		10	10	11	12	13	14	15	16	17	81
Remedy	Have the original manufacturer readjust the regulator.	Vehicle skid specifications: less than 3.28 fcet (1 m) at low speed.	Have the original manufacturer readjust the regulator.	Have the original manufacturer readjust the regulator.	Specifications:   I beyond the specified range, replace the LST engine.	Remove and clean the F-R slide, or replace it with a new one.	Remove and clean the adjustment port.	i) Tightly close the additional pressure reducing valve.	ii) Close the high- pressure reducing valve and clean.	i) Readjust the cable of the control slide valve of the loader.	ii) Install the regulator spring.	Remova and have the original manufacturer repair.
Causo	The regulator is maladjusted.		The regulator is maladjusted.	The regulator is maladjusted.	6. At the neutral position, the machine goes down a specified range, replace the LST engine. If beyond the specified range, replace the LST engine.	7. The machine continues to move, oven when the F-R solenoid valve's slide does not move smoothly due lever is at the neutral position.	8. The engine speed goes up when the machine starts. Presence of foreign matters in the temperature adjustment point. 9. The machine cannot reach the maximum speed.	10. The machine moves neither forward nor backward. I) The additional pressure reducing valve of the LST engine is i) Tighily close the additional pressure reducing valve. fully open.	ii) Presence of metallic particles in the loop circuit at the   ii) Close the high- pressure reducing valve, and clean, pressure reducing valve.	11. The engine does not start with the starter motor. i) The lever of the loader is maladjusted and the control slide   i) Readjust the cable of the control slide valve of the loader.	ii) The regulator spring is missing.	12. The machine decelerates all of a sudden to low. The high- pressure oil in the Hi- Lo piston is limited because. Remove and have the original manufacturer repair, speed during traveling at high speed.
Trouble	3. The machine skids when stopping it.		4. The machine starts (or stops) with a great shock. The regulator is maladjusted	<ol><li>The machine starts swerving when the F-R (Forward-Backward) lever is at the neutral position.</li></ol>	6. At the neutral position, the machine goes down a slope.	7. The machine continues to move, even when the F-R lever is at the neutral position.	The engine speed goes up when the machine starts.     The machine cannot reach the maximum speed.	10. The machine moves neither forward nor backward.		11. The engine does not start with the starter motor.		12. The machine decelerates all of a sudden to low speed during traveling at high speed.

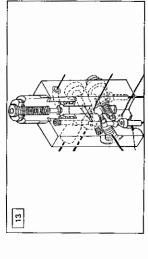
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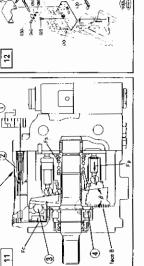
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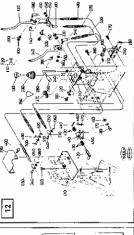




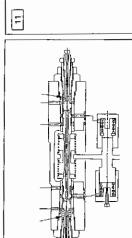


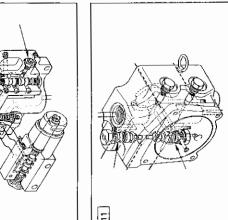


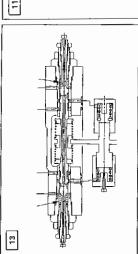




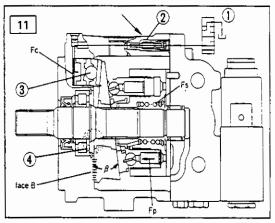


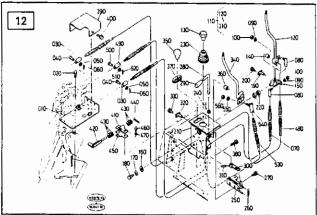




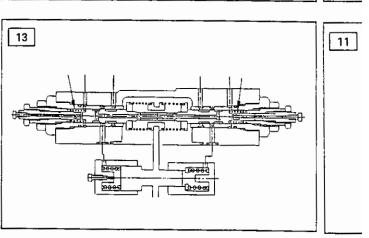


Trouble	Causc	
3. The machine skids when stopping it.	The regulator is maladjusted.	Have the origin
		Vehicle skid spe speed.
4. The machine starts (or stops) with a great shock.	The regulator is maladjusted.	Have the origin
5. The machine starts swerving when the F-R (Forward- Backward) lever is at the neutral position.	The regulator is maladjusted.	Have the origin
6. At the neutral position, the machine goes down a slope.	A certain distance of descent is allowable within the specified range.	Specifications: If beyond the
7. The machine continues to move, even when the F-R lever is at the neutral position.	The F-R solenoid valve's slide does not move smoothly due to foreign matters or the like.	Remove and cle
8. The engine speed goes up when the machine starts.	Presence of foreign matters in the temperature adjustment	Remove and cl
9. The machine cannot reach the maximum speed.	port. (The difference of control pressure is insufficient.)	
10. The machine moves neither forward nor backward.	i) The additional pressure reducing valve of the LST engine is fully open.	i) Tightly close
	ii) Presence of metallic particles in the loop circuit at the pressure reducing valve.	ii) Close the hi
11. The engine does not start with the starter motor.	i) The lever of the loader is maladjusted and the control slide valve is not at the neutral position.	i) Readjust the
	ii) The regulator spring is missing.	ii) Install the re
12. The machine decelerates all of a sudden to low speed during traveling at high speed.	The high- pressure oil in the Hi- Lo piston is limited because of foreign matters or for other reasons.	Remove and h

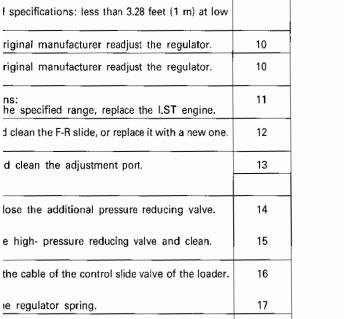


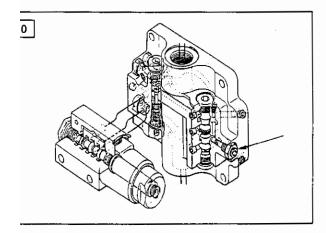


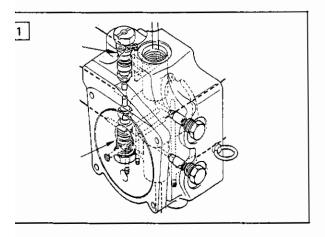
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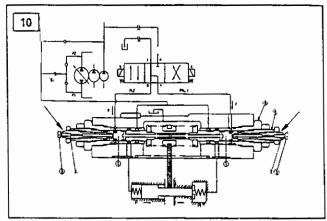


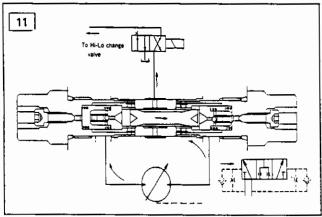
Remedy	Fig
riginal manufacturer readjust the regulator.	10
I specifications: less than 3.28 feet (1 m) at low	
riginal manufacturer readjust the regulator.	10
riginal manufacturer readjust the regulator.	10
ns: he specified range, replace the LST engine.	11
d clean the F-R slide, or replace it with a new one.	12
d clean the adjustment port.	13
lose the additional pressure reducing valve.	14
e high- pressure reducing valve and clean.	15
the cable of the control slide valve of the loader.	16
ne regulator spring.	17_
d have the original manufacturer repair.	18

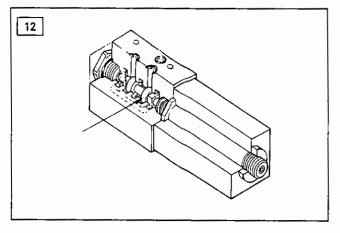


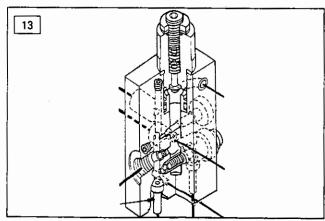










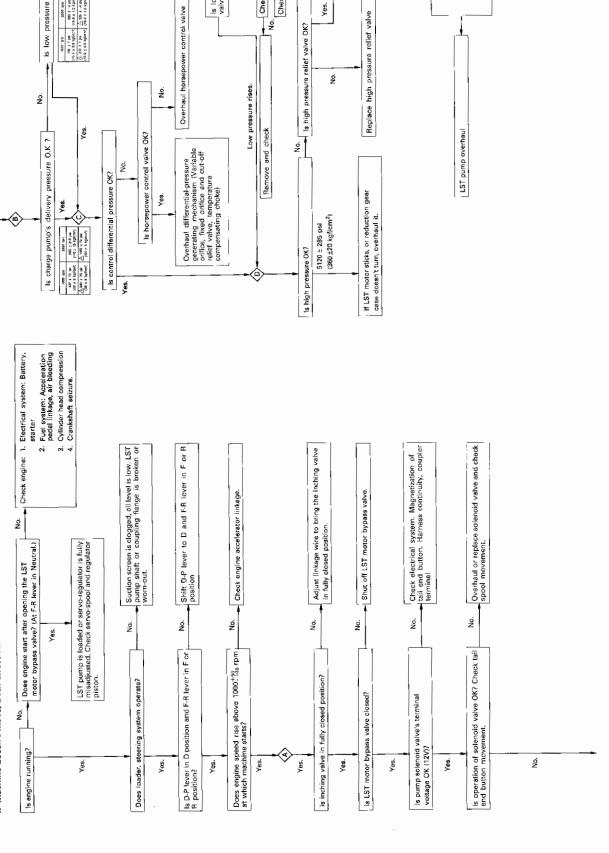


movement, snapring installation at cylinder block, seizure of piston and cylinder block, damage of valve plate or retainer, or casting defects.

LST motor overhaul. Check low pressure selector valve

Overhaul charge pump

b. Troubleshooting flow chartl. Machine doesn't move, both direction



8 8 1 1 ş

Check negative brake case for internal leakage

Check bypass relief valve

ģ

Test charge pump flow

Ñō.

ÖK.

Yes.

Š.

Is low pressure relief valve (Charge relief valve) adjustment OK?

Š

Is low pressure (charge pressure) OK ?

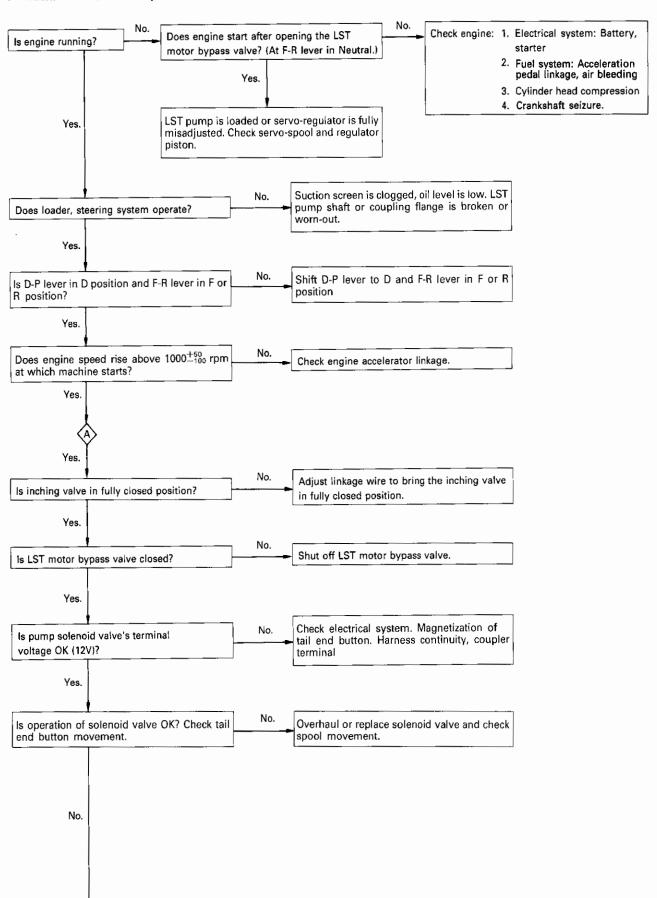
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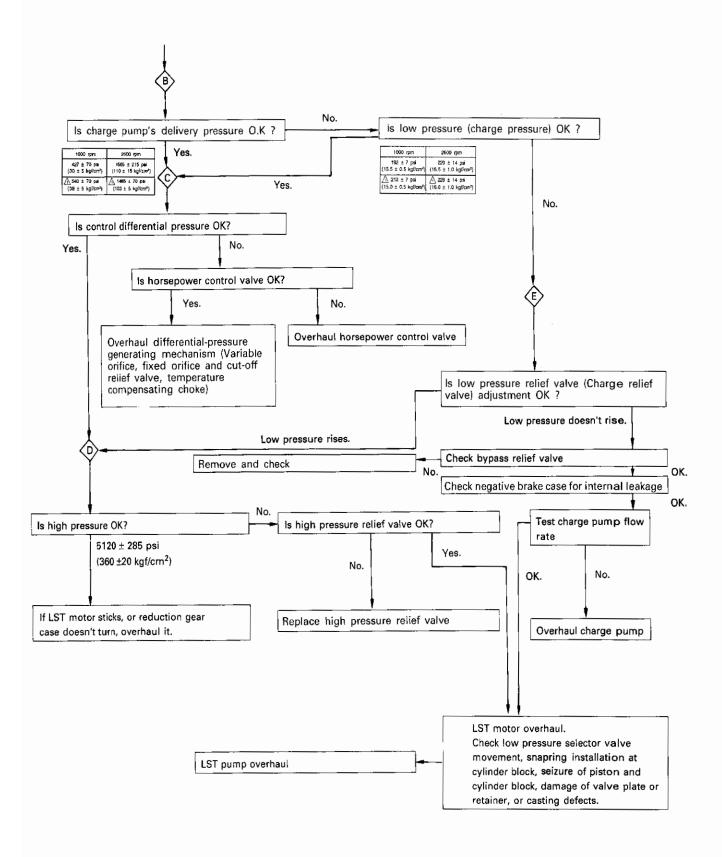
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Low pressure doesn't rise,

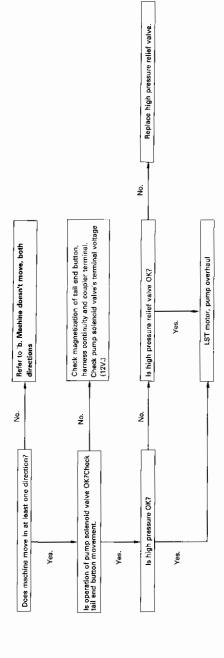
## b. Troubleshooting flow chart

## 1. Machine doesn't move, both direction

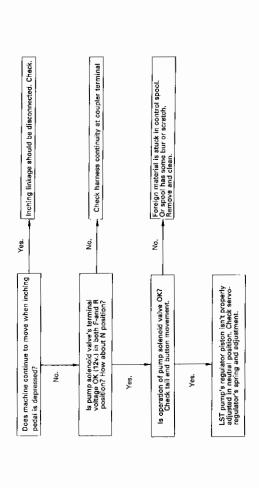




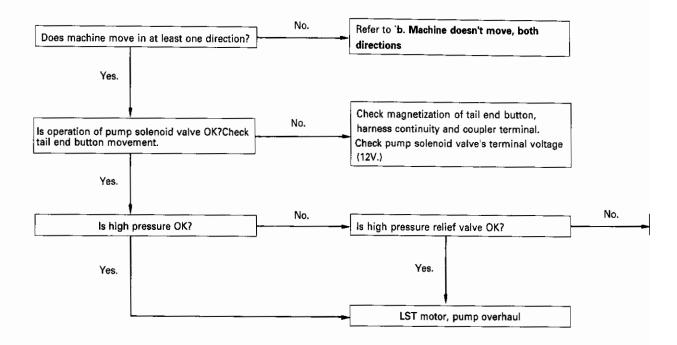
# 2. Machine doesn't move, forward or reverse



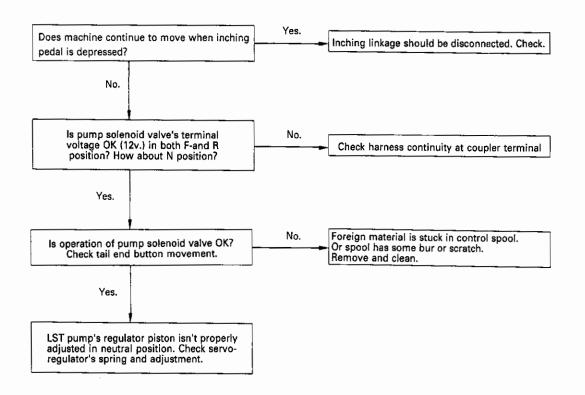
# 3. Machine moves in neutral position of F-R lever



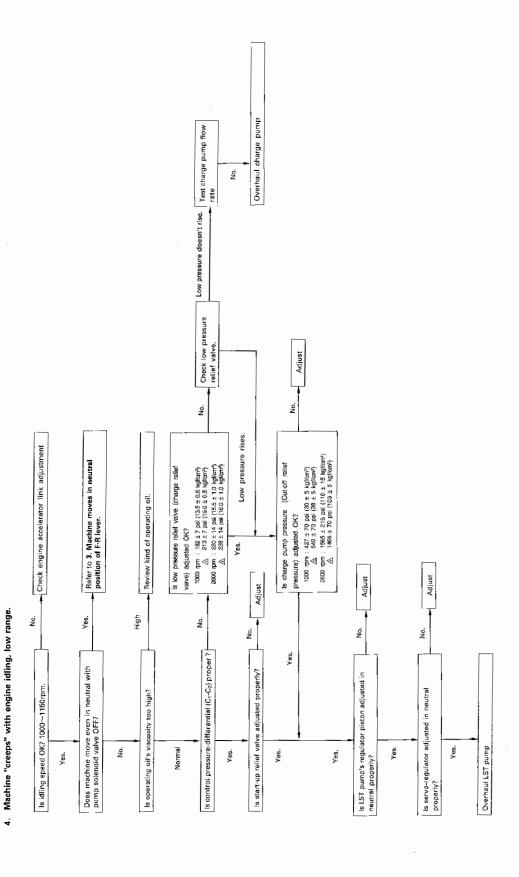
# 2. Machine doesn't move, forward or reverse



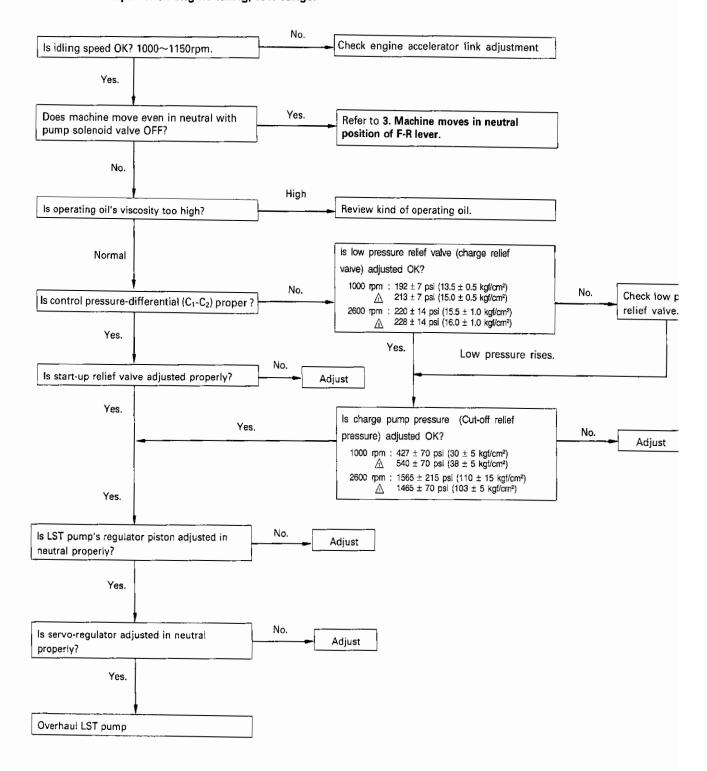
## 3. Machine moves in neutral position of F-R lever

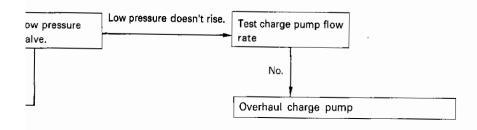


Replace high pressure relief valve.

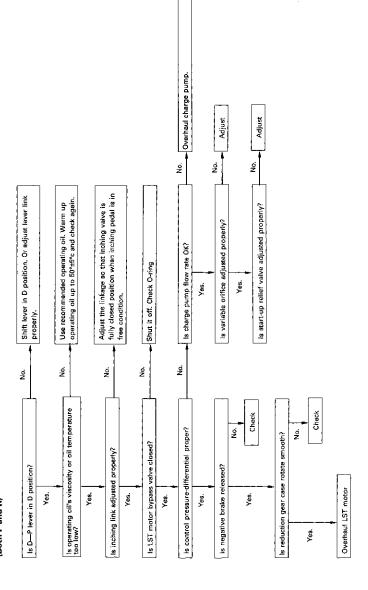


# 4. Machine "creeps" with engine idling, low range.

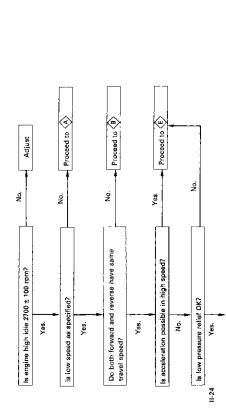


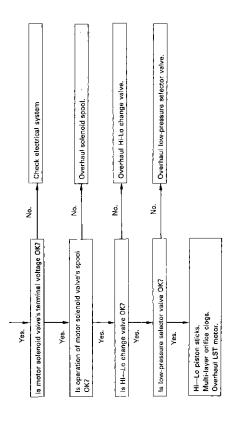


# Engine RPM of machine start-up is high (Both F and R)

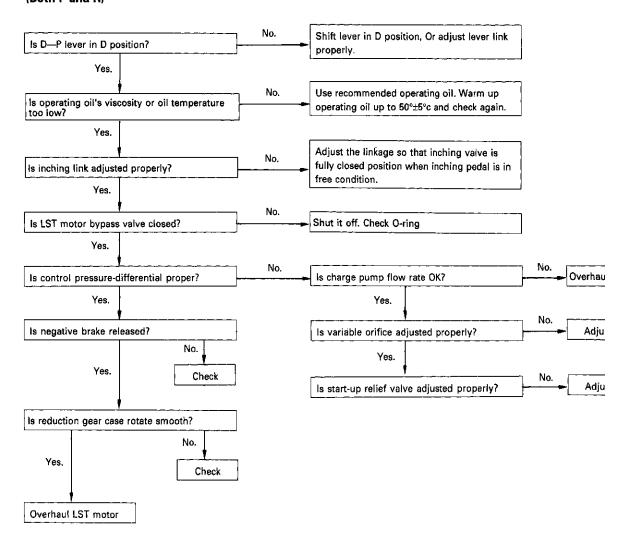


# 6. Ground speed is too slow.

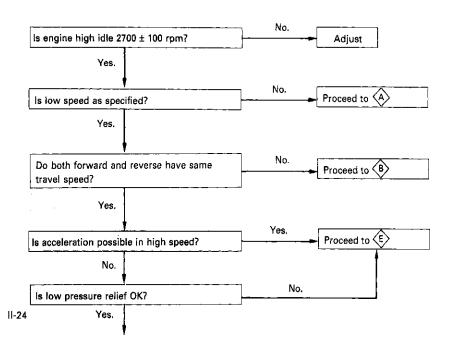




# 5. Engine RPM of machine start-up is high (Both F and R)



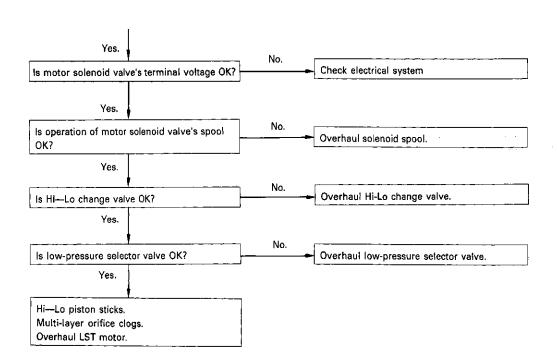
### 6. Ground speed is too slow.



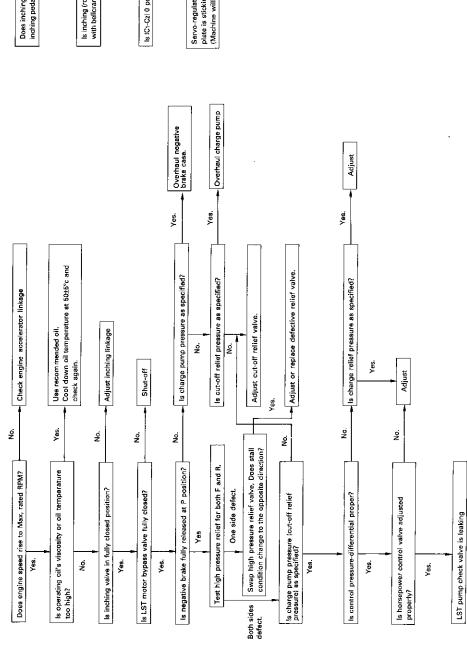
haul charge pump.

ıdjust

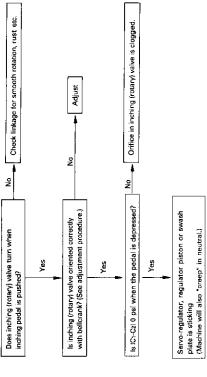
\djust



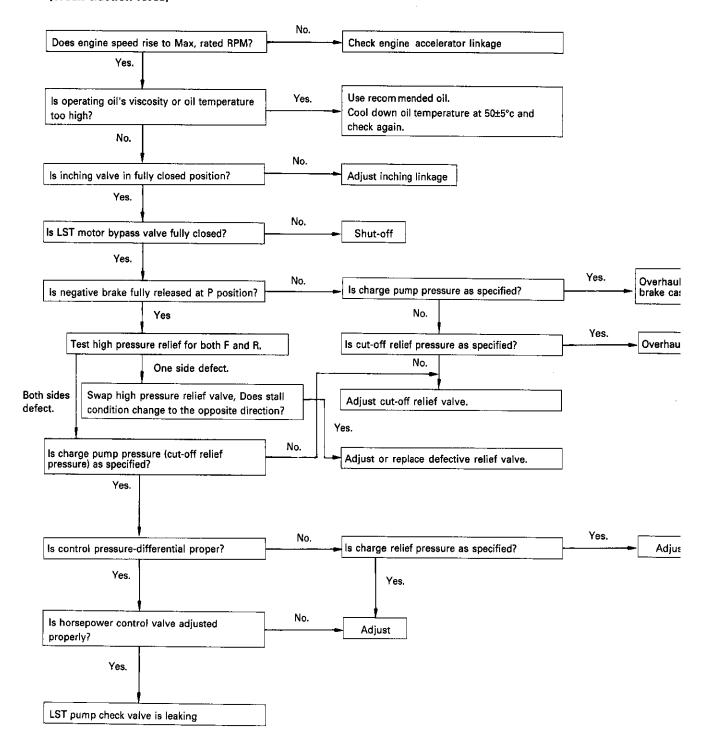
# 7. Machine stalls, low range. (Weak traction force)



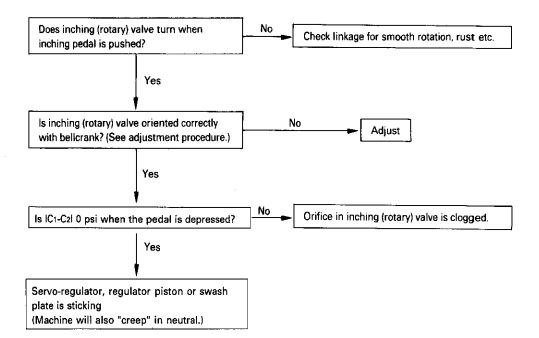
# 8. Inching pedal will not regulate speed.



# 7. Machine stalls, low range. (Weak traction force)



# 8. Inching pedal will not regulate speed.

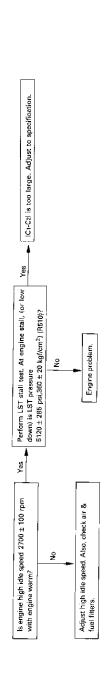


haul negative scase.

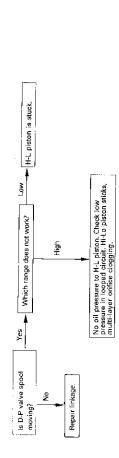
rhaul charge pump

djust

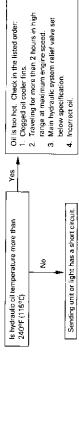
# 9. Engine stalls under load, low range



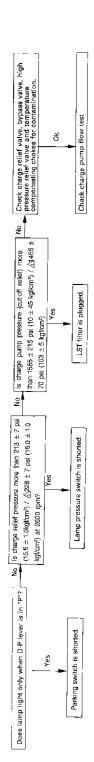
# Travel speed doesn't change when H-L lever is shifted.



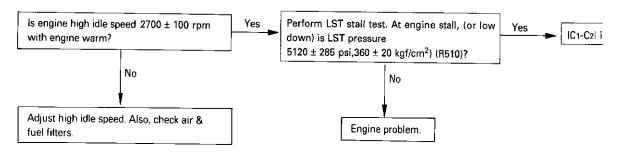
11. LST oil temp. lamp lights



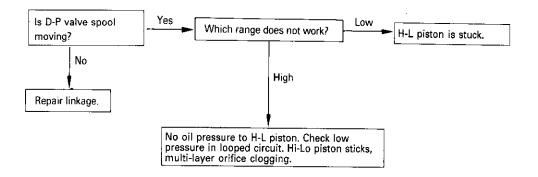
12. LST oil pressure lamp lights



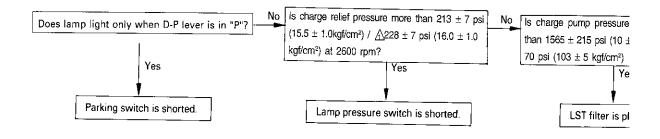
# 9. Engine stalls under load, low range



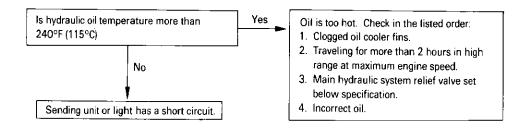
# 10. Travel speed doesn't change when H-L lever is shifted.

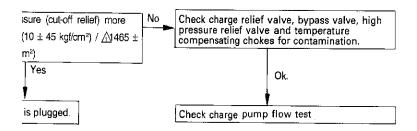


## 12. LST oil pressure lamp lights



# 11. LST oil temp. lamp lights





## C. Testing and Adjustment

#### a. Outline of test

To quickly and efficiently locate and correct problems on the LST, you will be required to perform various tests throughout the troubleshooting procedure.

When the flow chart calls for a test, locate the test and perform it. Then, proceed until you have located the trouble.

#### <Test instruments>

Flow meter (in-line type)

- 8.0 gal/min (30 \( \)/min) ... Charge pump
- 21 gal/min (80 \( \frac{1}{2} \) /min) ... Main pump
- 40 gal/min (150 ½/min) ... LST pump, LST motor

#### Pressure gauge

- 355 psi (25 kgf/cm²) ... Charge relief pressure
- 2130 psi (150 kgf/cm<sup>2</sup>) ... Servo-regulator control pressure (C<sub>1</sub>, C<sub>2</sub>)
- 2130 psi (150 kgf/cm2)...Charge pump pressure
- 4200 psi (300 kgf/cm²) ... Relief pressure of Front loader and Backhoe
- 6000 psi (420 kgf/cm²) ... LST high pressure

#### Fittings to connect the above

- ① Servo-regulator control pressure:1/4"
- (2) LST high pressure: 1/4"
- 3 Charge pump pressure: 1/8"
- 4 Charge relief pressure; 1/4"
- Main pump pressure port:1/8"
- 6 LST pump & motor flow test:3/4"
- Tlow meter for charge pump:3/8"
- 8 Flow meter for main pump:1/2"

# b. Handling precaution of LST system components

#### 1. Oil

(1) Applicable operating oil

Operating oil plays an important role of transmitting power and lubricating each hydraulic component. It may have the most serious effect on the performance and service life of the hydraulic components depending on the way it is selected and handled.

Generally, operating oil must be of very good quality, have good lubricating property, be stable against oxidation, and be resistant to rusting and emulsification. It must also be of such quality as not to corrode packings, seals, etc.

Designated operating oil: Engine oil SAE 10W-30

Operating viscosity range Applicable range: 25 to 100 cst Practical range: 20 to 500

If the hydraulic system involved is to start in cold weather, warm up the system without any load on

Oil temperature range: -20 to +90°C, -4 to 194°F(In oil tank)

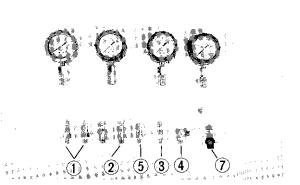
#### (2) Maintenance of operating oil

Operating oil, which is clean at first, will become contaminated with deposits, such as sludge, formed in the circuit and the tank, as it is used for a long period of time. Such contaminated oil flowing in the circuit can be a cause of damaged piston pump.

Also, operating oil itself will deteriorate with time, and wear on the sliding parts will advance with worsening lubricating property.

It is therefore desirable to inspect the operating oil periodically, to judge the degree of deterioration, and if necessary, to replace it with new one. But it would be difficult to judge the degree of contamination or deterioration periodically at the site. In view of this difficulty, a rough visual method to judge is shown in the table below for reference purposes.

Hydraulic oil should be replaced with new one every about 500 hours of operation. Be sure to flush the tank and the pipes to remove deteriorated operating oil, deposits such as sludge, and moisture from them before substituting new operating oil. (Otherwise, the LST system will malfunction or its service life will be shortened.)



 Place operating oil sample from the middle of tank in a test tube for comparison with new oil

External appearance	Odor	Oil condition	Remedy
Transparent (No color change)	Good	Good	Use as is
Transparent (Small black spots)	Good	With foreign material	Filtrate before use
Turned milky- white	Good	With moisture	Change oil
Turned black	Malodor	Oxidized and deteriorated	Change oil

#### 2. Filter

(1) Appropriate filter installation

The piston pump/motor is built with precision parts, and designed with a very small clearance between each part.

Therefore, the motor is very sensitive, especially to contaminations (sludge, iron particles, rust, powders produced by filing, and grinding powders).

Deteriorated performance of the piston pump/motor, or excessive wear on its sliding parts can be prevented almost entirely by holding down the contamination level.

If hydraulic oil in the hydraulic system is to be kept clean to use the system as a reliable one that will withstand long-term use with a minimum of repair and inspection, suitable filters need to be installed in the system to maintain the degree of contamination within NAS 9 level.

Install filters of 10 or less (nominal) in filtration. If the element of a filter is apt to be clogged, replace the filter with one that incorporates an indicator to show the element's clogged state to the outside, and a relief valve to bypass the flow through it.

Recommended degree of contamination = within NAS 9 class

#### (2) Maintenance of filter

Filters need to be checked periodically because if the elements are clogged, they won't function properly due to their filtration performance deteriorating.

Periodically change LST oil cartridge at first 500 hours and every 500 hours onwards.

#### 3. Installation

- Be sure to pickle pipes before installation to remove scale and other foreign matter from their interior.
- (2) Take due care to prevent foreign matter from entering the pump/motor case through each port during piping work.
- (3) Thoroughly flush pipes after installation.
- (4) Design the drain pipe so that the pressure in the pump/motor case will not rise above 14.2 psi (1 kgf/cm²) under steady conditions.
- (5) Return oil in the drain pipe separately and directly to the tank.
  Specifications for drain pressure in pump/motor case under steady conditions: 14.2 psi (1 kgf/cm²) or less
  Momentary maximum: 42.6 psi (3 kgf/cm²) or less
- (6) The pump/motor case meeds to be filled with hydraulic oil for lubrication. Design the drain pipe so as to rise one stage above the piston pump proper before returning to the tank.
- 4. Procedure to start the LST system

After installing on the machine a new LST system, or one serviced and inspected, inspect and make preparations for starting the machine with the following procedure:

- Fill the pump/motor case with operation oil.
   Loosening the plugs in the air bleeding ports (PF1/2") facilitates this filling step.
  - Note: When a hand pump or a small electric motor is to be used to fill operating oil, take care not to cause the pressure in the pump/motor case to rise above 42.6 psi (3 kgf/cm<sup>2</sup>).
- (2) Bleed air from each pipe.
- (3) Start the engine and run it at low speed.
- (4) Operate the LST system at a light load several times to bleed air from the pipes. Also, check the components and pipes for oil leakage.
- (5) After bleeding air and checking for oil leakage, operate the LST system at a normal load to check to see whether or not abnormal sound, vibration, or the like is produced from the LST system. If this checks out satisfactorily, proceed to operate the system for actual work.
- 5. Operating oil temperature during actual work It is a very important problem to what temperature to hold the temperature of a hydraulic component. If the operating oil temperature is too high, the oxidation resistance of the oil will fall, accelerating its deterioration. Therefore, observe the following precautions:
  - (1) Use operating oil within the range from 50 to 176°F 10 to 80°C if the system is to be operated continuously.
  - (2) Do not start the system below -40°F -20°C. Up to 203°F 95°C is acceptable if the system is to be operated for a short time.

#### C. Start-up engine RPM

#### <Procedure>

- 1. Place the machine on flat ground.
- Slowly depressing the accelerator pedal, check the engine RPM when machine begins to move.
- Test both forward and reverse direction, Both engine rpm should be identical.

Oil temp.: 122±41°F (50±5°C)

#### <Specifications>

1100 + 50 RPM (Low range)

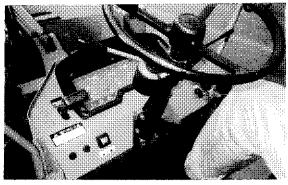
#### <Adjustment>

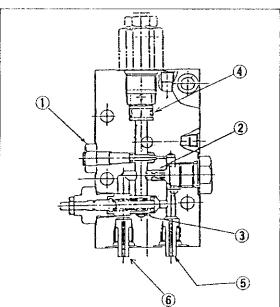
Think if start-up engine RPM is low, servo-control pressure differential is high, and vice-versa. This improper pressure differential is mainly caused by contamination or misadjustment of orifices, chokes and relief valves.

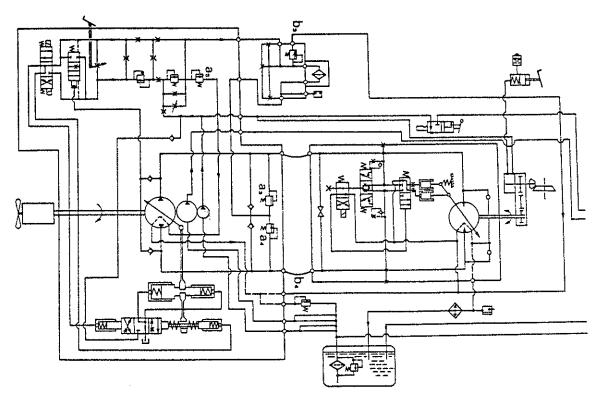
If start-up engine RPM of both F and R isn't identical, think servo-regulator or regulator piston aren't set in neutral!

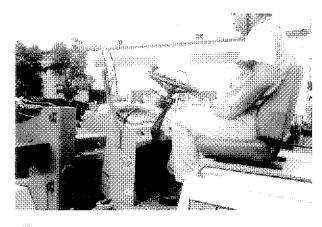
- (1) Variable orifice

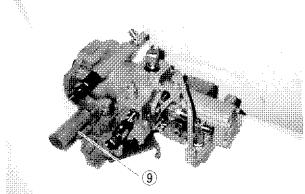
- 2 Fixed orifice
  3 Cut-off relief valve
  4 Charge relief valve
  5 Temperature compensating choke
- (6) Temperature compensating choke











#### d. Machine neutral condition

#### <Procedure>

- 1. Place the machine on the flat ground.
- Start the engine, shift the lever to H or L range and F-R lever to neutral.
- 3. Accelerate the pedal and machine shouldn't move.

#### (Note)

Machine may keep moving slowly even after shifting the lever from F or R to neutral position. Depress the inching pedal, machine should stop. If not, adjust as below.

#### <Adjustment>

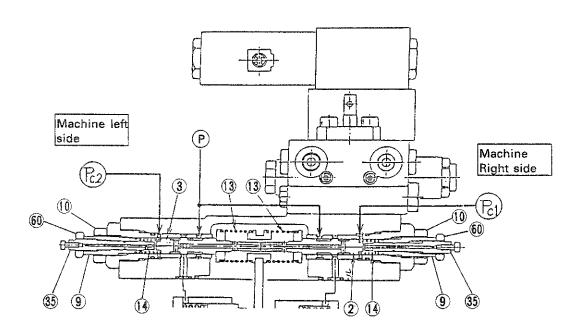
Neutral adjusting plugs are installed in both side of regulator. Use one side plug for adjusting while the other is locked.

- When vehicle moves to Forward: Either plug should be slided to right direction in below Fig. (Return plug R or screw in plug L)
- When vehicle moves to reverse: Either plug should be slided to left direction in below Fig. (Screw in plug R or return plug L)
- 3. Air bleeding is required in some case.

P: Regulator piston operating pressure

Pc1, Pc2: Servo-control pressure

- 2 Sleeve
- 3 Spool
- 9 Plug, L, R (Neutral adjusting )
- 10 Lock nut (M16)
- (13) Spring F1, F2
- 14 Spring ft, f2
- Stopper L, R (Shock adjusting)
- 60 Lock nut (M10)
- 61 Air bleeding plug



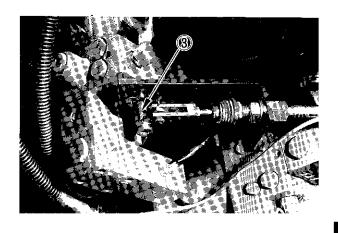
### e. Inching spool & pedal adjustment

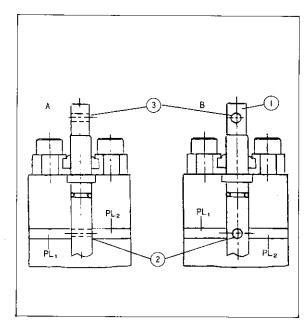
- 1. Right Fig shows inching spool is in fully closed position.
- 2. Spool position
  - Spring pin bole is parallel with pump main shaft. →
     Fully closed condition.
  - Spring pin hole is in right-left side direction.→ Fully open condition.
  - A: Fully opened position
  - B: Completely closed position
  - 1 Inching spool
  - (2) Oil bypassing hole
  - (3) Spring pin hole

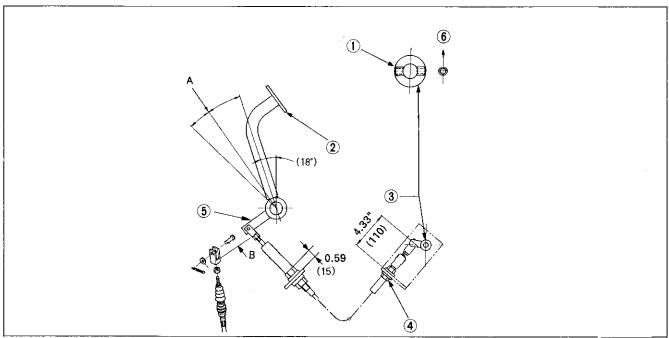
#### 3. Adjustment

- (1) Connect wire end with brake pedal arm.
- 2 Tighten lock nut at the center of adjusting screw
- 3 Connect other wire end with inching arm and adjust its distance to 4.33 in (110m).
- 4 Brake pedal stopper bolt should be locked at the position that brake pedal is 18 degree declined from vertical, remaining 0.04" (1mm) brake push rod play.
- 1) Spring pin
- 2 Brake pedal
- 3 LST inching spool
- 4 Control cable outer adjusting side
- (5) Brake arm
- 6 Spring pin split direction

Inching Stroke	Force	13.2 lbs (6 kgf)
	Stroke	1.57" (40 mm)
Braking stroke	Force	78.9 lbs (35.8 kgf)
	Stroke	0.79" (20 mm)







## f. Warning lamp operation

 Turn the startor key to one stage (AC position), reversely (preheat position) and start engine.
 Check warning lamp condition as below.

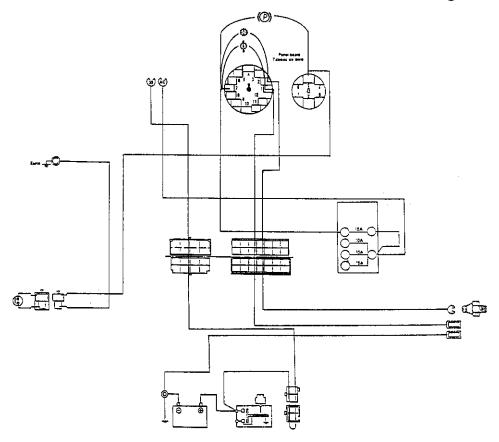
	startor key position or machine condition	<u> </u>	(D)	<u>-0-</u> /		ø_	<b>⊕</b> !
1	AC position (P position)	0	0	0	×	×	0
2	Preheat position (P position)	0	0	0	0	×	0
3	Engine start (P position)	×	$\circ$	×	×	×	0
4	Parking brake lever in D position	×	×	×	×	×	×
5	LST 10mfilter clogged (circuit is low pressure below 7k)	×	×	×	×	×	0
6	LST looped line temp. above 115°C	×	×	×	×	0	×

: light up

X: light off

# \*Vehicle is designed to be "Parking start".

- 2. If result isn't satisfactory, test below items.
- 1 Battery + line terminal for 12V
- 2 Continuity test for each switch.
- 3 Continuity test for each line lead wire to earth.



#### g. Solenoid valve function (F-R, Hi-Lo)

- Connect the wireharness, turn the start switch on (1st stage) and check the solenoid spool motion by shifting the F-N-R lever, or Hi-Lo switch.
  - 1 Solenoid valve end button
  - 2 Coupleur



F-R-Lever	Pump solenoid valve end button
N → F	Right side button comes out
N → R	Left side button comes out

Hi-Lo switch	Motor solenoid valve end button
LO → Hi	Come in
Hi → Lo	Come out

Approx. stroke: 0.12 in (3 mm) each.

Operating voltage:
 Pump solenoid: 9 ~ 16 V
 Motor solenoid: 10 ~ 14 V

• Continuity test of pump coupler F: (A) (Brown) - (C) (Red white)

R: B (Orange) - D (Yellow blue)

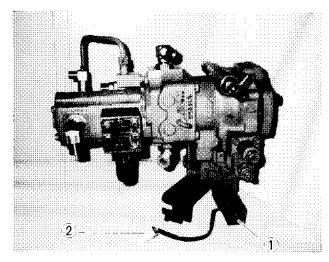
Continuity test of motor coupler

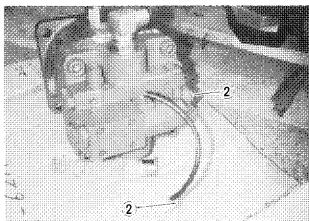
(White) -(F) (white, blue)

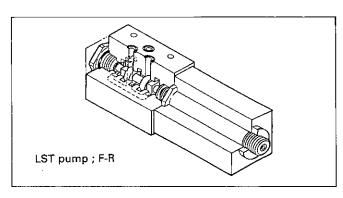
· Continuity test coil.

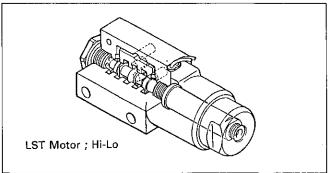
Pump solenoid:  $5.6\Omega$  (20°C) Motor solenoid:  $5.1\Omega$  (20°C)

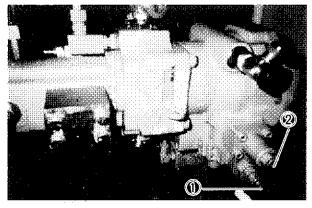
2. Check if spool move smoothly in the valve block.

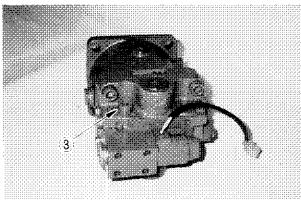












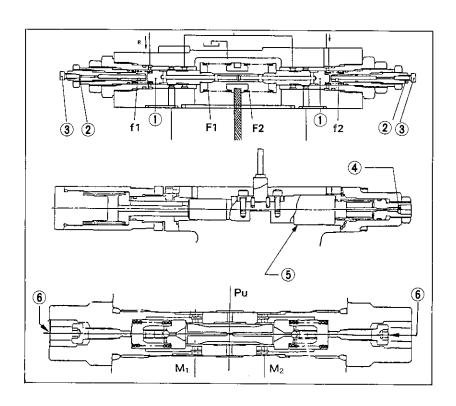
#### h. Air bleeding

- 1. Air bleeding locations
  - 1) Servo-regulator, both sides tip end
  - 2 Regulator piston large dia side end
  - 3 LST motor, low pressure selector valve
- 2. When need air bleeding
  - 1 Start-up engine RPM is out of spec.
  - 2 Hi-Lo speed change or speed acceleration is abnormal.
  - (3) Vahicle's neutral isn't possible
  - 4 Abnormal noise
  - 5 After long term storage
  - 6 Component overhaul
- 3 How to conduct air bleeding
  - 1 Check oil level in the tank and replenish if need.
  - Fill appropriate oil in LST pump-motor cases after overhaul.
  - 3 Start engine and keep running with idle speed in neutral for a while.
  - 4 Accelerating the engine rpm to middle speed, shift F-R lever and Hi-Lo switch for several times.

<Note> Air bleeding plug shouldn't return more than 1.5

Plug tightening torque: 2.97 ft-lbs (0.41 kgf-m)

L wrench size: 3 mm



- ) Spool
- Shock adjusting stopper
- 3 Air bleeding plug
- 4 Air bleeding plug
- (5) Regilator piston
- 6 Air bleeding plug

#### i Travelling speed

- 1. Run the vehicle at the maximum speed.
- 2. Take time (seconds) required for 65 ft (20m) travelling.

#### <Specification>

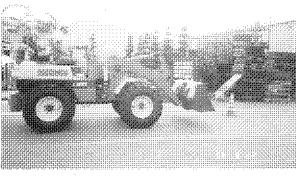
F•H	mile/h (km/h)	10.0 ± 0.3 (16.0 ± 0.5)
R•H	sec./65 ft (20m)	4.3 ~ 4.7
F•L	mile/h (km/h)	$4.35 \pm 0.3 \ (7.0 \pm 0.5)$
R-L	sec./65•ft (20m)	9.6 ~ 11.0

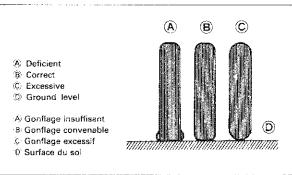
Oil temp: 122 ±41°F (50 ± 5°C)

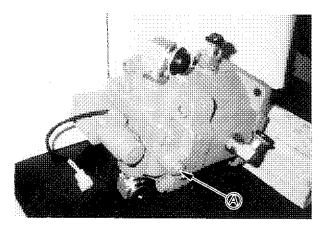
#### <Adjustment>

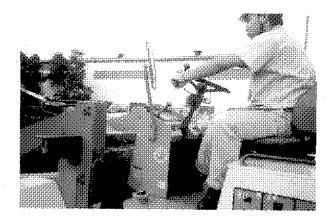
If test result is out of specification, check below items and adjust.

- 1) Engine max rated rpm: 2600 ± 100 rpm. if not, adjust accelerator linkage.
- Tire pressure (Front, rear): 31.2 ± 1.4 psi (2.2 ± 0.1 kgf/cm²)
- 3 Check if LST motor bypass valve is completely closed. Even if bypass valve is opened by two turns, vehicle runs approx 70% (L), 50% (H) of rated speed.
- 4 If high speed is insufficient, approximately same as low speed, then think Hi-Lo speed change circuit is malfunctioning.
- (5) If both high and low speed are insufficient, check below.
  - · Negative brake isn't released fully
  - · LST pump delivery rate is low.
  - · LST motor has large leakage
- (6) Machine weight difference affects travel speed slightly.
- (A) Bypass valve









#### j Vehicle's shock and drift when start and stop.

- 1. Run the vehicle at max. speed
- 2. Shift F•R lever quickly from F to R or R to F.
- 3. Watch tire's drift distance before changing direction.
- 4. Also evaluate travelling shock when start and stop.

#### <Specification>

Travel drifting distance: Within 3.28 ft (1m) vehicle starting

Vehicle starting shock: 0.3G

Condition: Lo speed range, No load with STD weight

Oil temp: 122 ± 41°F (50 ± 5°C)

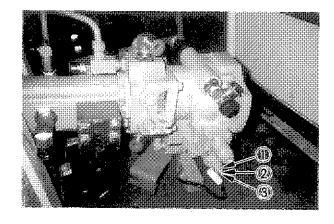
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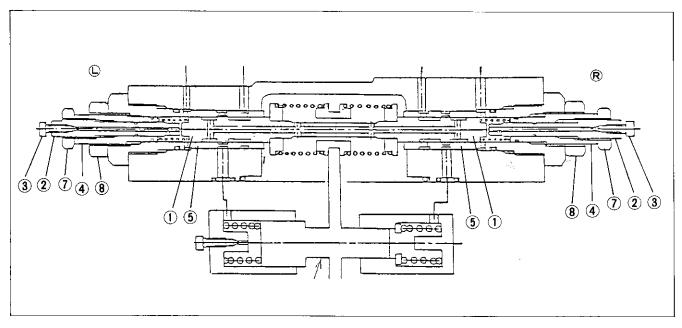
Above malfunction can be adjusted by stopper plug of servoregulator—shown in table.

Adjusting points		Forward		
		Starting response	Stopping shock or drift	
1 . 5	Screw in	To decrease shock	No change	
Left side stopper	Return	To increase shock	No change	
Right side stopper	Screw in	No change	To decrease shock	
	Return	No change	To increase shock	

Adjusting points		Reverse		
		Starting response	Stopping shock or drift	
l oft oids stanner	Screw in	No change	To increase drifting	
Left side stopper	Return	No change	To increase shock	
Right side	Screw in	To decrease shock	No change	
stopper	Return	To increase shock	No change	

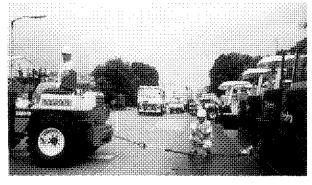
- Points to adjust: 1 in order to correct dull response condition in start or long drifting condition in stop, return the stopper slightly in necessary side.
  - ② In order to decrease shock in stop and start, screw in the stopper slightly.
  - 3 Stopper adjusting angle should be per 15 degree.
  - 4 Max. stopper adjusting length is approx 2 ~ 3 mm.
  - (5) Lock nut tightening torque: 11.5  $\pm$  0.6 ft (1.59  $\pm$  0.08 kgf/cm) Spanner size:
  - 1) Lock nut
  - 2 Adjusting stopper plug
  - 3 Air bleeding plug

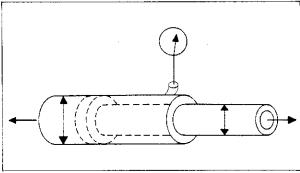


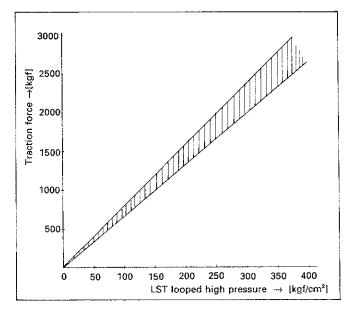


- 1 Servo-spool
- 2 Shock adjusting stopper
- 3 Air bleeding plug
- 4 Neutral adjusting plug
- 5 Servo-sleeve
- 6 Choke
- O Lock nut
- 8 Lock nut
- (L) Machine left hand side
- (R) Machine right hand side

- 1 Tiroir d'asservissement
- 2 Butée de réglage de choc
- 3 Bouchon de purge d'air
- 4 Bouchon de réglage du point-mort
- 5 Chemise d'asservisssment
- 6 Diffuseur
- 7 Contre-écrou
- (8) Contre-ecrou
- (1) Machine direction à gauche
- R Machine direction à droite







#### k. Traction force

#### <Procedure>

- 1. Prepare testing tools and connect them as shown in Fig.
- Pull the cylinder rod with Max. engine rpm up to tire's stall condition. (Before tire slipping)
- 3. Read the pressure gauge and calculate the traction force.

(Example)

Cylinder size: Ø 30 x Ø 70 Pressure opplying area:  $\frac{\pi}{4}$  (7²-3²) Pressure gauge reading: 90 kgf/cm² Then, traction force is,  $\frac{\pi}{4}$ (7²-3²)\*90 equals to 2829 kgf

<Specification>

High	1985 ± 220 lbf (900 ± 100 kgf) ≦
Low	6175 ± 220 lbf (2800 ± 100 kgf) ≤

#### <Adjustment>

1. If traction force is out of specification, follow the troubleshooting flow chart.

#### I. LST dynamic brake

#### <Procedure>

- Safety
  - Before conducting the test, securely check service brake functions normally.
- 2. Run the vehicle at max. travel speed for acceleration distance of 65.6 ft (20 m) or more.
- Release the acceleration pedal and measure the distance the loader has traceled until complete stop.
   Do not apply service brake.

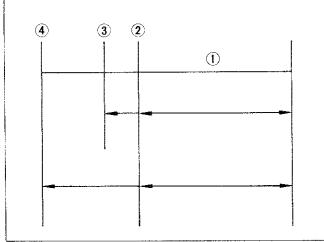
#### <Specification>

F•H	13.1 ± 1.6 ft (4.0 ± 0.5 m)
F•L	$3.3 \pm 1.6 \text{ ft}$ (1.0 ± 0.5 m)

Condition: No load, STD counterweight Oil temp 122  $\pm$  41°F (50  $\pm$  5°C)

- (1) Acceleration distance 65.6 ft (20 m)
- 2 Release acceleration pedal
- (3) Complete stop, low speed
- (4) Complete stop, high speed







#### m. Travelling block performance

#### <Procedure>

- 1. Slowly travel forward (low range) on the slope up to measuring line.
- 2. Shift the F•R lever to neutral and release the accelerator pedal to idling.
- Measure the distance vehicle's descending for 10 minutes.

#### <Specification>

 $6.56 \pm 1.64 \text{ ft } (2.0 \pm 0.5 \text{m})/30 \text{ seconds}$ 

 $\triangle$  < 9.84 ft (3.0m)/30 seconds

Condition: Oil temp, 122  $\pm$  41°F (50  $\pm$  5°C)

No load, STD counterweight

Slope angle.  $\alpha = 15^{\circ}$ 

Note: Machine weight, slope angle and oil temp, affect to the descending distance.

#### <Adjustment>

If rolling down distance is over specification, check below items.

- 1 Motor bypass valve for loosening
- (2) Check valve for contamination
- (3) Low pressure selector valve for malfunction
- (4) Motor assy for excessive internal leakage

#### n. Charge pump pressure test

Install the pressure gauge at test port on charge pump as shown in photo.

#### <Test condition>

Oil temperature:  $122 \pm 41^{\circ}F (50 \pm 5^{\circ}C)$ 

H-L-P range: H or L F-N-R range: N

① Charge pump pressure port

#### <Specification>

	R510
Engine 1000 rpm	427 ± 71 psi (30 ± 5 kgf/cm <sup>2</sup> )
Engine 2600 rpm	$1565 \pm 213$ psi (110 ± 15 kgf/cm <sup>2</sup> )

#### <Adjustment>

Adjust the setting pressure by turning the screw in the cutoff relief valve.

# Low pressure relief valve test (Charge relief pressure test)

install the pressure gauge at test port on LST filter flange as shown in photo.

#### <Test condition>

Oil temperature: 122  $\pm$  41°F (50  $\pm$  5°C)

H-L-P range: H or L F-N-R range: N

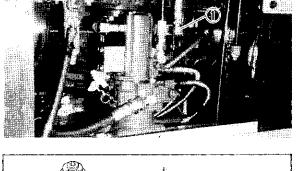
① Charge relief pressure port

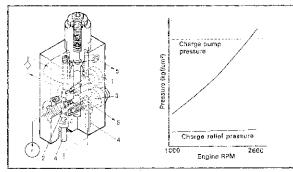
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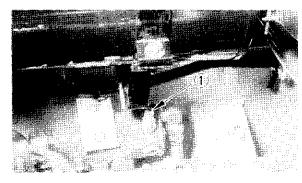
	R510
Engine 1000 rpm	$192 \pm 7$ psi $(13.5 \pm 0.5 \text{ kgf/cm}^2)$
Engine 2600 rpm	$220 \pm 14 \text{ psi } (15.5 \pm 1.0 \text{ kgf/cm}^2)$

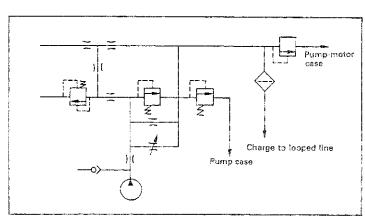
#### <Adjustment>

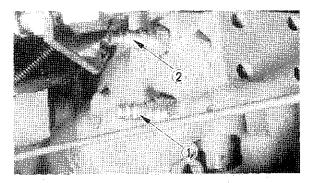
Adjust the setting pressure by adding or reducing the shims in the charge relief valve.

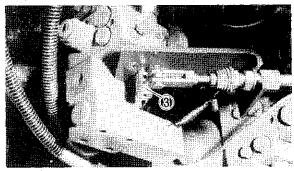


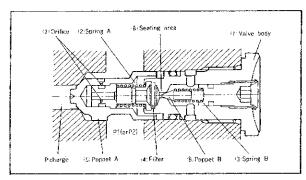


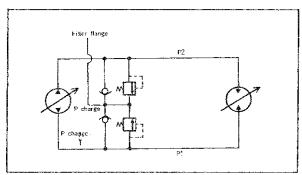












#### p. LST stall pressure test

Install the pressure gauge at gauge port and lift up the machine and keep it safely.

Stall the machine.

#### Machine stalling methods

- (1) Disconnect the inching link, start the engine and get the rated RPM. Shift the lever to H range and F or R, depress the brake pedal instantly to stall machine.
- (2) Remove the hydraulic hose for the brake so that negative brake functions.
  - 1 High pressure port: Reverse
  - 2 High pressure port: Forward
  - 3 Inching arm

#### <Test condition>

Oil temperature:  $122 \pm 41^{\circ}\text{F}$  (50  $\pm$  5°C) in the tank

Engine: Max. rated 2600 rpm

H-L-P range: H only F-N-R range: F and R

#### <Specification>

 $5120 \pm 285 \text{ psi}$ (360 ± 20 kgf/cm<sup>2</sup>)

#### <Check points>

- (a) Adjusting screw lock punching condition.
- (b) Poppet B seat is clean from dust, scratch etc. Air should not be passed by flowing from (X) to (Y) after removing valve body.
- © Poppet A's sliding part and seat should be clean from dust, scratch etc.

#### <Adjustment>

If the tested pressure is out of specification, adjust.

## q. Lower pressure test in LST looped circuit

Same test procedure & test condition

#### <Specification>

Engine 1000 rpm: 170 psi (12 kgf/cm<sup>2</sup>) or more 2600 rpm;

#### n. Charge pump pressure test

Install the pressure gauge at test port on charge pump as shown in photo.

#### <Test condition>

Oil temperature: 122  $\pm$  41°F (50  $\pm$  5°C)

H-L-P range: H or L F-N-R range: N

① Charge pump pressure port

#### <Specification>

	R510
Engine 1000 rpm	$398 \pm 30 \text{ psi } (28 \pm 2 \text{ kgf/cm}^2)$
Engine 2600 rpm	1350 $\pm$ 115 psi (95 $\pm$ 8 kgf/cm <sup>2</sup> )

#### <Adjustment>

Adjust the setting pressure by turning the screw in the cutoff relief valve.

# Low pressure relief valve test (Charge relief pressure test)

Install the pressure gauge at test port on LST filter flange as shown in photo.

#### <Test condition>

Oil temperature: 122  $\pm$  41°F (50  $\pm$  5°C)

H-L-P range: H or L F-N-R range: N

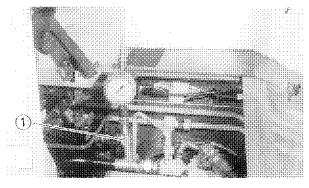
① Charge relief pressure port

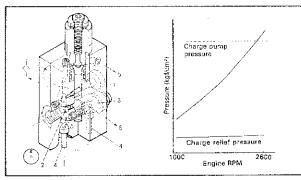
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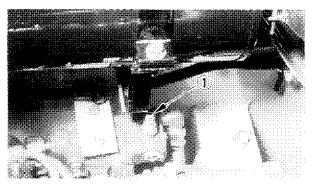
	R510
Engine 1000 rpm	213 ± 7 psi (15.0 ± 0.5 kgf/cm ²)
Engine 2600 rpm	228 ± 14 psi (16.0 ± 1.0 kgf/cm <sup>2</sup> )

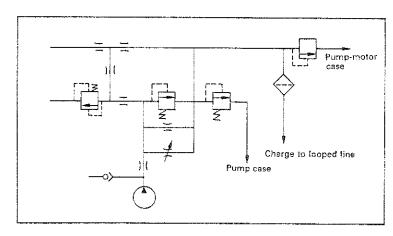
#### <Adjustment>

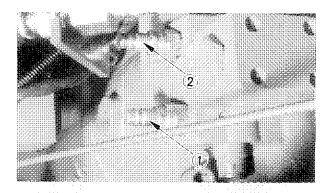
Adjust the setting pressure by adding or reducing the shims in the charge relief valve.

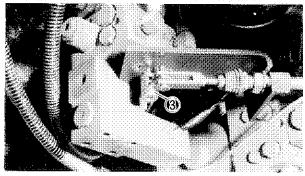


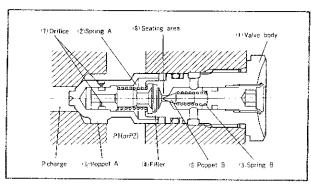


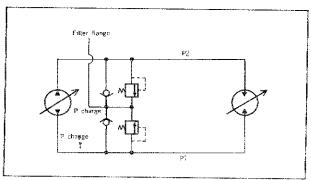












#### p. LST stall pressure test

Install the pressure gauge at gauge port and lift up the machine and keep it safely.

Stall the machine.

#### Machine stalling methods

- (1) Disconnect the inching link, start the engine and get the rated RPM. Shift the lever to H range and F or R, depress the brake pedal instantly to stall machine.
- (2) Remove the hydraulic hose for the brake so that negative brake functions.
  - High pressure port: Reverse
  - 2 High pressure port: Forward
  - 3 Inching arm

#### <Test condition>

Oil temperature:  $122 \pm 41^{\circ}\text{F}$  (50  $\pm$  5°C) in the tank

Engine: Max. rated 2600 rpm

H-L-P range: H only F-N-R range: F and R

#### <Specification>

 $5405 \pm 425 \text{ psi}$ (380 ± 30 kgf/cm<sup>2</sup>)

#### <Check points>

- a Adjusting screw lock punching condition.
- (b) Poppet B seat is clean from dust, scratch etc. Air should not be passed by flowing from (X) to (Y) after removing valve body.
- © Poppet A's sliding part and seat should be clean from dust, scratch etc.

#### <Adjustment>

If the tested pressure is out of specification, adjust.

#### q. Lower pressure test in LST looped circuit

Same test procedure & test condition

#### <Specification>

Engine 1000 rpm: 170 psi (12 kgf/cm<sup>2</sup>) or more 2600 rpm;

# r. Servo-regulator control pressure differential (C1, C2)

Install the pressure gauge as shown in the photo. When checking the pressure, machine should be raised off ground.

(A): C1

(B): C2

#### <Test condition>

Oil temperature:  $122 \pm 41^{\circ}F$  (50  $\pm 5^{\circ}C$ )

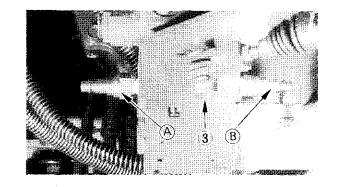
H-L-P range: H or L F-N-R range: N

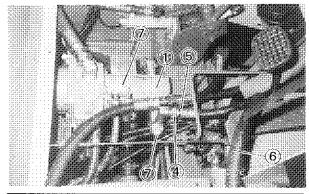
• Inching arm 3 should be disconnected and inching spool be fully closed.

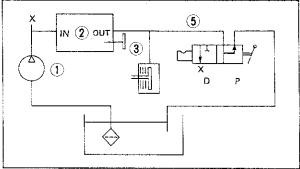


		psi (kgf/c
Engine rpm	1000	2600
C1 (C2)	256 ± 7 (18.0 ± 0.5)	597 ± 14 (42.0 ± 1.0)
C2 (C1)	249 ± 7 (17.5 ± 0.5)	512 ± 14 (36 ±1.0)
F: C1 C2 R: C2 C1		85 ± 14 (6.0 ± 1.0)

<u> </u>		psi (kgf/cm²)
Engine rpm	1000	2600
C1 (C2)	285 ± 7 (20.0 ± 0.5)	590 ± 14 (41.5 ± 1.0)
C2 (C1)	270 ± 7 (19.0 ± 0.5)	484 ± 14 (34.0 ± 1.0)
F: C1 - C2 R: C2 - C1	14.2 (1.0)	107 ± 14 (7.5 ± 1.0)







#### Charge pump flow test

- Disconnect charge pump delivery hose to P-D valve and connect flow meter as shown in photo and circuit diagram.
- Remove piping and joint counector between charge pump and LST pump and plug on it.

(This is to lead all charge pump flow to meter.)

- Important: P-D lever should be in P position shifting. to D position causes hose burst.
- 4. Accelerate engine to Max. rated rpm and read flow rate and pressure. Use the flow meter load control to set pressure. Make sure oil temperature is 122  $\pm$  41°F (50  $\pm$  5°C).
  - 1 Charge pump
  - (2) Flow test meter
  - 3 Loading handle
  - 4 From charge pump
  - 5 To P-D valve
  - (6) To flow test meter
  - 7 Plug

#### <Test condition>

Engine: Max. rated 2600 rpm

Oil temperature: 122 ± 41°F (50 ± 5°C)

P-D valve F-N-R range: N

#### <Specification>

<specification></specification>		<u> </u>	
Factory spec.	No load	0.56 ± 0.01 in <sup>3</sup> (9.2 ± 0.2 cc/rev)	0.42 ± 0.01 in <sup>3</sup> (6.9 ± 0.2 cc/rev)
	Load 95%≤	$0.54 \pm 0.01 \text{ in}^3$ (8.85 ± 0.2 cc/rev)	$0.40 \pm 0.01 \text{ in}^3$ (6.56 $\pm$ 0.2 cc/rev)
	Loading pressure	1705 psi (120 kgf/cm²)	1705 psi (120 kgf/cm²)
Service limit 80%		0.34 in <sup>3</sup> (7.52 cc/rev)	0.34 in³ (5.52 cc/rev)
Theoretical discha	rge	0.57 in <sup>3</sup> (9.4 cc/rev)	0.43 in³ (7.0 cc/rev)

- 1 Flow test port
- ② Charge pump pressure test port

#### <Service>

If the pump flow rate is less than service limit. check internal surface of pump body and bushing side wear condition.

#### t. LST Pump delivery test (No load, load)

#### <Procedure>

 Install the flow meter after disconnecting the looped circuit hose between LST pump and LST motor as shown in Fig.

Disconnect inching pedal wire and check if inching spool doesn't rotate by depressing the pedal.In other words, inching spool should be in the complete colsed condition. Spring pin of inching arm and LST pump shaft should be paralled.

Machine should be raised off the ground. Use the stand for SAFETY.



#### Caution

The connection shown left is for testing in the forward direction.

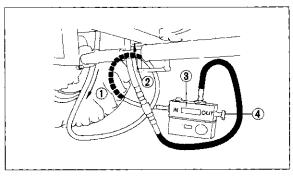
DO NOT shift into reverse, or the flow meter may be damaged.

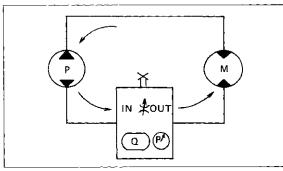
- 1 From LST pump (A) port
- 3 Flow meter
- ② To LST motor A port
- 4 Loading handle

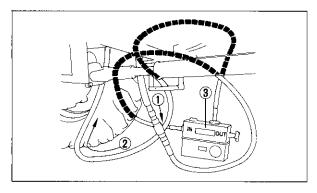
#### (Note) Engine rpm = Pump rpm

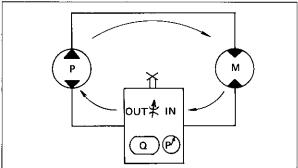
#### <Specifications>

Theoretical discharge (100%) x 2600 rpm		0 ~ 2.745 in3 (0 ~ 45 cc/rev) 0 ~ 30.9 gal/min (0 ~ 117 g/min)
New machine condition	Load: 710 psi (50 kgf/cm²)	2.68 ± 0.15 in <sup>3</sup> (44.0 ± 2.5 cc/rev) 29.59 gal/min (110.0 ½/min) at 2550 rpm
	1420 psi (100 kgf/cm²)	2.62 ± 0.12 in <sup>3</sup> (43.0 ± 2.0 cc/rev) 28.40 gal/min (107.5 ℓ /min) at 2500 rpm
	2135 psi (150 kgf/cm²)	2.20 ± 0.09 in <sup>3</sup> (36.0 ± 1.5 cc/rev) 22.85 gal/min (86.5 ℓ /min) at 2400 rpm
	2840 psi (200 kgf/cm²)	1.71 ± 0.06 in <sup>3</sup> (28.0 ± 1.0 cc/rev) 16.25 gal/min (61.5 ℓ /min) at 2200 rpm









## u. LST motor test

#### <Procedure>

 Raise up unit off the ground by using front loader and backhoe outrigger.

Use the stand for SAFETY.

Inching spool should be in completely closed condition

2. Flow test pump.

(This indicates flow rate into motor)

3. Reverse hose connection and the direction switch and load test again.

(This indicates motor out flow rate)

## <Specifications>

Theoretical discharge		Lo: 3.97 in <sup>3</sup> Hi: 1.68 in <sup>3</sup> Lo: 65.0 cc/rev Hi: 27.5 cc/rev
New machine condition	Load: 710 psi (50 kgf/cm²)	$2.59 \pm 0.15 \text{ in}^3$ (42.5 $\pm 2.5 \text{ cc/rev}$ ) 28.67 gal/min (108.5 $\ell$ /min) at 2550 rpm
	1420 psi (100 kgf/cm²)	2.38 ± 0.12 in <sup>3</sup> (39 ± 2.0 cc/rev) 25.76 gal/min (97.5 ½ /min) at 2500 rpm
	2135 psi (150 kgf/cm²)	$1.74 \pm 0.09 \text{ in}^3$ (28.5 ± 1.5 cc/rev) 16.91 gal/min (64.0 $\ell$ /min) at 2250 rpm
	2840 psi (200 kgf/cm²)	1.13 ± 0.06 in <sup>3</sup> (18.5 ± 1.0 cc/rev) 10.70 gal/min (40.5 ½ /min) at 2200 rpm

## D. ALST Components Servicing

# a. LST pump assy removing and reinstalling (Identification plate No.)

#### 1. Drain oil.

Engine oil 10W-30	R510 (B)
Tank capacity	12.9 gal (49 ½)
System total (without Backhoe)	15.9 gal (60 ℓ)
System total (with Backhoe)	17.2 gal (65 ℓ )

- 1 Inlet port cover
- Level gauge
- (3) Drain port

#### (When reinstalling)

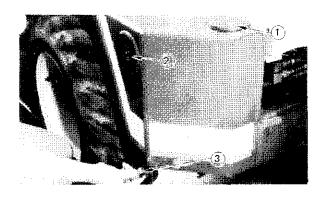
Refill the indicated oil volume in the tank and add further 0.13 gal (0.5 $\ell$ ) into LST pump before starting the engine. Add oil until level is centered in sight glass.

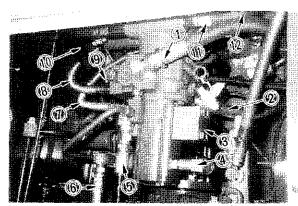
#### 2. Remove the floor board.

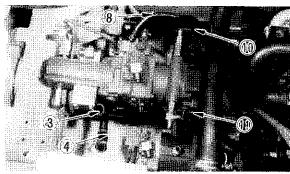
3. Remove the connecting hoses.

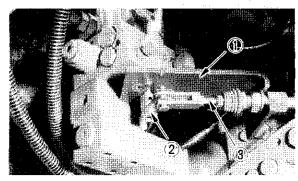
Place the oil pan below the machine to get oil.

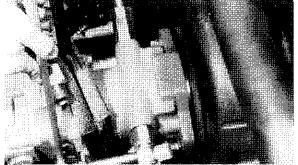
- <Hoses to be removed>
- 1 Looped line (P2), Forward
- (2) Looped line (P1), Reverse
- 3 Main pump, suction
- (4) Charge pump, suction
- (5) Mainpump, delivery to steering controller P port
- 6 Charge pump, delivery to P-D valve
- 7 Charge pump, delivery to negative brake case
- 8 From 10 μ filter
- To 10 μ filter
- 10 Bypass valve ~ Tank
- From filter flange bypass relief
- (2) LST pump ~ motor case
- 4. Disconnect inching pedal control cable.
  - 1 Inching bracket
  - 2 Inching arm
  - 3 Control cable

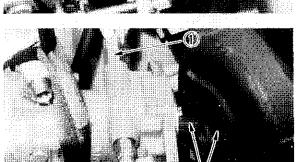


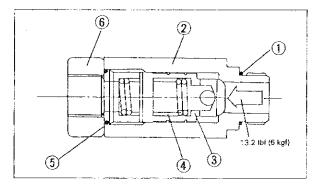


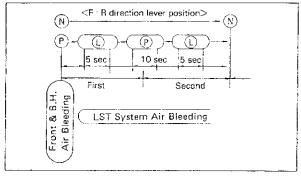












 Put the wire sling around pump assy and hang it up.
 Loosen the mounting bolts and pull the pump assy to rear direction.

Assy weight: 121 lbs (55 kgf) Mounting bolt: M16 x 40, 7T

Tightening torque: 145 ~ 166 ft.lbf

(20.0 ~ 23.0 kgf.m)

#### (when reinstalling)

Apply grease on pump shaft spline and install into coupling flange. \*

Shaft runaway should be less than 0.004 in. (0.1 mm) Pump shaft should be fit in smoothly.

6. Lift LST pump assy up.

7. Remove bypass relief valve assy ①

Pay attention oil in the pump case flowing out when removing.

Check poppet must work with 13.2 lbf (6 kgf) pushing force.

Spring free length: 1.69 in (43 mm)

Number of coils: 11, dia.: 0.06 in. (\$1.6)

Tightening torque: 72.3 ~ 86.8 ft.lbf (10 ~ 12 kgf.m)

- ① O-ring
- 2 Poppet adaptor
- 3 Poppet
- 4 Spring
- ⑤ O-ring
- 6 Spring adaptor

#### <Air Bleeding>

Whenever overhauling the LST system component, bleed the air out of the line, as shown in the procedure.

If need, bleed air by loosening plugs on LST pump regulator and LST motor.

## D. ALST Components Servicing

# a. LST pump assy removing and reinstalling (Identification plate No.)

#### 1. Drain oil.

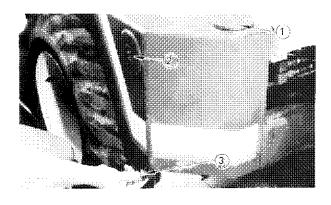
Engine oil 10W-30	R510 (B)
Tank capacity	12.9 gal (49 ℓ )
System total (without Backhoe)	15.9 gal (60 ℓ)
System total (with Backhoe)	17.2 gal (65 ℓ)

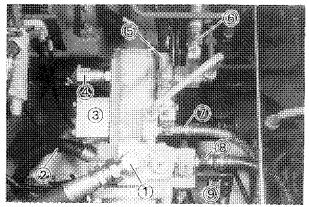
- 1 Inlet port cover
- (2) Level gauge
- ③ Drain port

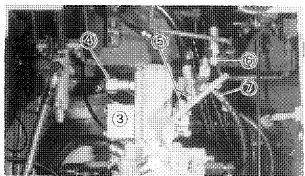
#### (When reinstalling)

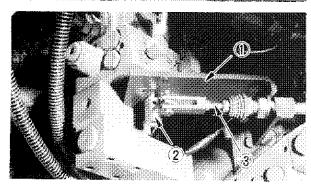
Refill the indicated oil volume in the tank and add further 0.13 gal (0.5%) into LST pump before starting the engine. Add oil until level is centered in sight glass.

- Remove the floor board.
- Remove the connecting hoses.
   Place the oil pan below the machine to get oil.
  - <Hoses to be removed>
  - 1 Looped line (P2), Forward
  - 2 Looped line (P1), Reverse
  - 3 Main pump, suction
  - 4 Charge pump, suction
  - (5) Main pump, delivery to priority valve P port
  - (6) Charge pump, delivery to P-D valve
  - 7) Charge pump, delivery to negative brake case
  - (8) From 10 μ filter
  - 9 To 10 μ filter

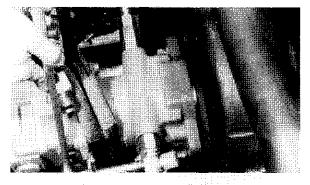


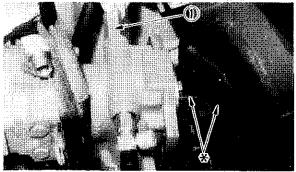


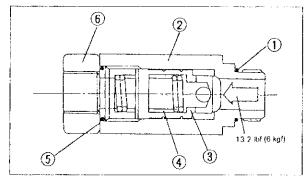


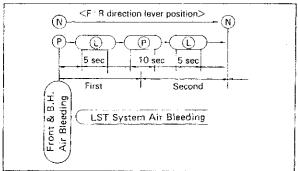


- 4. Disconnect inching pedal control cable.
  - ① Inching bracket
  - 2 Inching arm
  - ③ Control cable









Put the wire sling around pump assy and hang it up.
 Loosen the mounting bolts and pull the pump assy to rear direction.

Assy weight: 121 lbs (55 kgf) Mounting bolt: M16 x 40, 7T

Tightening torque: 145 ~ 166 ft.lbf

(20.0 ~ 23.0 kgf.m)

#### (when reinstalling)

Apply grease on pump shaft spline and install into coupling flange. \*

Shaft runaway should be less than 0.004 in. (0.1 mm) Pump shaft should be fit in smoothly.

6. Lift LST pump assy up.

7. Remove bypass relief valve assy ①

Pay attention oil in the pump case flowing out when removing.

Check poppet must work with 13.2 lbf (6 kgf) pushing force.

Spring free length: 1.69 in (43 mm) Number of coils: 11, dia.: 0.06 in. (e1.6)

Tightening torque: 72.3 ~ 86.8 ft.lbf (10 ~ 12 kgf.m)

- ① O-ring
- ② Poppet adaptor
- 3 Poppet
- 4 Spring
- ⑤ O-ring
- 6 Spring adaptor

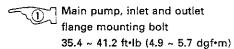
#### <Air Bleeding>

Whenever overhauling the LST system component, bleed the air out of the line, as shown in the procedure.

If need, bleed air by loosening plugs on LST pump regulator and LST motor.

#### (When reassembling) R510:

Replace all soft materials, seal and O-ring. Tightening torque of connector and adaptor;



2 Main pump, inlet connector 72.2 ~ 86.8 ft+lb (10.0 ~ 12.0 kgf+m)

3 LST pump, looped line L-bow 86.8 ~ 94.0 ft\*ib (12.0 ~ 13.0 kgf\*m)

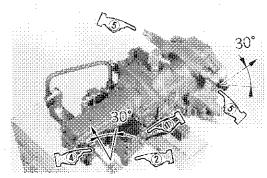
Charge pump, inlet L-bow 43.4 ~ 47.0 ft•lb (6.0 ~ 6.5 kgf•m)

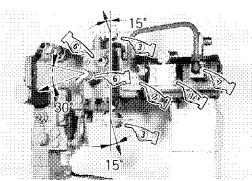
5 LST pump, adaptor 86.8 ~ 101.3 ft-lb (12.0 ~ 14.0 kgf-m)

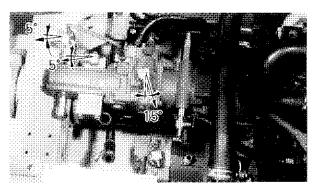
6 LST control valve, adaptor 57.9 ~ 72.3 ft-lb (8.0 ~ 10.0 kgf-m)

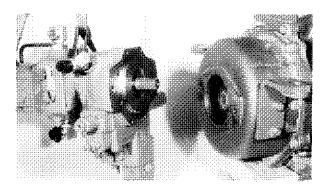
Connector 36.2 ~ 39.8 ft•lb (5.0 ~ 5.5 kgf•m)

Apply grease to the o-ring when tightening. Tightening torque for PT (tapered thread) and PF (straight thread) are as per the torque table. The gap between each hose should be more than 0.4 in (10 mm).









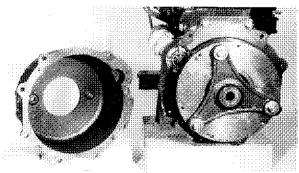
# reinstalling

Remove LST pump assy.

(When reinstalling)

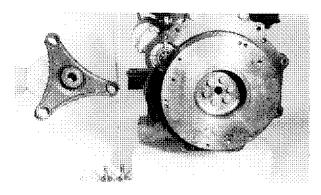
Grease splines and shaft will slip easily into pump coupler. Eccentricity of pump shaft and coupling flange should be within 0.004" (0.1 mm).

b. Pump housing and coupling flange removal/



2. Remove the pump housing.

Note position of reamer bolt, straight pin, and whether the mounting bolt are installed from housing side or engine

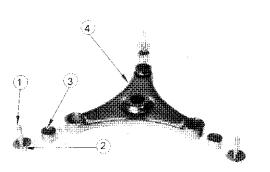


3. Remove the coupling flange

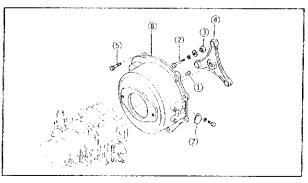
Tightening torque: 35.4 ~ 41.2 ft.lbf (4.9 to 5.7 kgf.m) Apply LOCKTIGHT.

Note: Longer boss side (0.49", 12.5 mm) of coupling flange must face pump mounting side.

When reassembly, clean dust & rust in spline section with wire brush.



- ① Bolt
- ② Washer
- 3 Rubber coupling
- Coupling flange

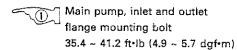


- 1 Straight pin
- 2 Bolt
- 3 Rubber coupling
- 4 Coupling flange
- 3 Bolt
- 6 Pump housing
- 7 Timing window

#### 

#### (When reassembling) R510:

Replace all soft materials, seal and O-ring. Tightening torque of connector and adaptor;



Main pump, inlet connector 72.2 ~ 86.8 ft•lb (10.0 ~ 12.0 kgf•m)

3 LST pump, looped line L-bow 86.8 ~ 94.0 ft-lb (12.0 ~ 13.0 kgf-m)

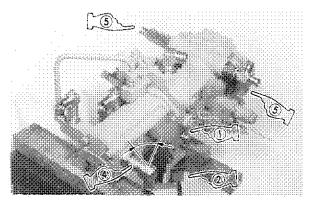
Charge pump, inlet L-bow 43.4 ~ 47.0 ft-lb (6.0 ~ 6.5 kgf-m)

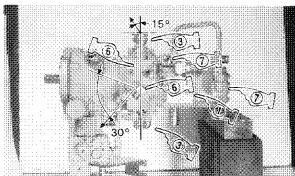
(5) LST pump, adaptor 86.8 ~ 101.3 ft-ib (12.0 ~ 14.0 kgf-m)

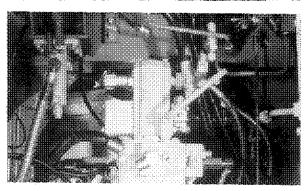
EST control valve, adaptor 57.9 ~ 72.3 ft-lb (8.0 ~ 10.0 kgf-m)

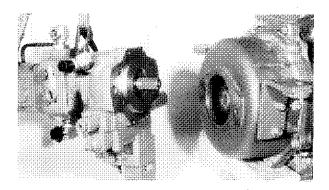
Connector 36.2 ~ 39.8 ft•lb (5.0 ~ 5.5 kgf•m)

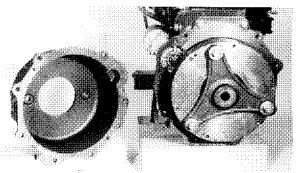
Apply grease to the o-ring when tightening. Tightening torque for PT (tapered thread) and PF (straight thread) are as per the torque table. The gap between each hose should be more than 0.4 in (10 mm).

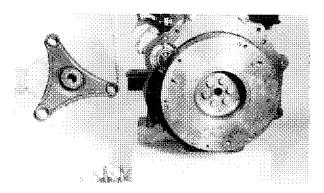


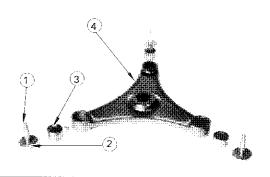


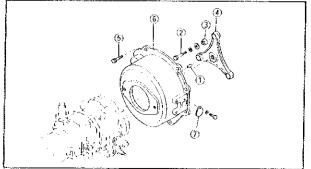












# b. Pump housing and coupling flange removal/ reinstalling

1. Remove LST pump assy.

(When reinstalling)

Grease splines and shaft will slip easily into pump coupler. Eccentricity of pump shaft and coupling flange shoald be within 0.004" (0.1 mm).

2. Remove the pump housing.

Note position of reamer bolt, straight pin, and whether the mounting bolt are installed from housing side or engine side.

Remove the coupling flange

Tightening torque: 35.4 ~ 41.2 ft.lbf (4.9 to 5.7 kgf.m) Apply LOCKTIGHT.

Note: Longer boss side (0.49", 12.5 mm) of coupling

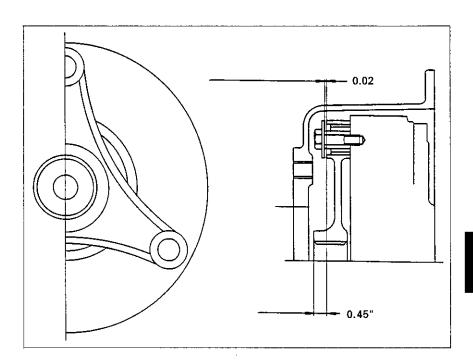
flange must face pump mounting side.

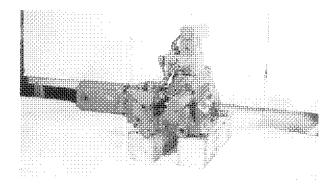
When reassembly, clean dust & rust in spline section with wire brush.

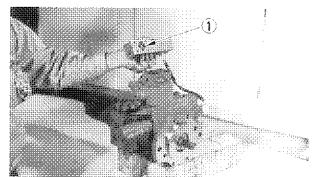
- 1 Bolt
- ② Washer
- 3 Rubber coupling
- Coupling flange

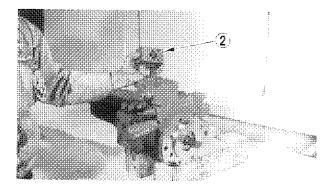
- ① Straight pin
- 2 Bolt
- 3 Rubber coupling
- 4 Coupling flange
- 5 Bolt
- 6 Pump housing
- 7 Timing window

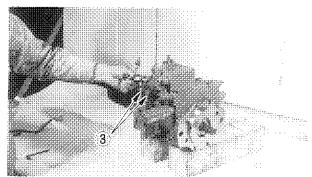
\* Coupling flange clearance should be 0.02" (0.5 mm)

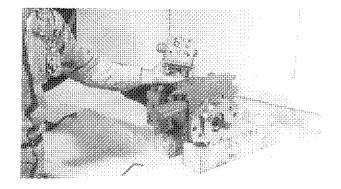












# c. Disassembly and reassembly of LST pump

 Lay down the LST pump assy on the working table using wooden block shown in photo.

- 2. Remove F-R solenoid valve.
  - ① O-ring
    Mounting bolt:

Torque:  $5.06 \pm 0.72$  ft·lb ( $0.7 \pm 0.1$  kgf·m)

- 3. Remove pick-up block of C1, C2 pressure gauge.
  - ② O-ring

4. Remove two pipes.

Tightening torque: 21.7 ~ 28.9 ft-lbs

(3.0 ~ 4.0 kgf.m)

③ Temperature compensating choke

- 5. Remove regulator sub-body.
  - 4 O-ring

Mounting bolt: M8 x

Torque: 23.9  $\pm$  1.4 ft•lb (2.3  $\pm$  0.2 kgf•m)

6. Remove servo-regulator.

Mounting bolt: M8 x 50.

Torque: 23.9  $\pm$  1.4 ft•lb (3.3  $\pm$  0.2 kgf•m)

(When reassembly) Securely check O-rings.

① O-rings

7. Separate main pump and charge pump as a assembly.

Mounting bolt: M10 x 25.

Torque: 32.5  $\pm$  1.7 ft-lb (4.5  $\pm$  0.23 kgf-m)

8. Remove LST valve sub-assy.

Mounting bolt: M8 x 40.

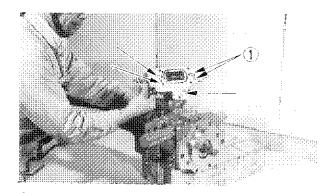
Torque: 23.9  $\pm$  1.4 ft-lb (2.3  $\pm$  0.2 kgf-m)

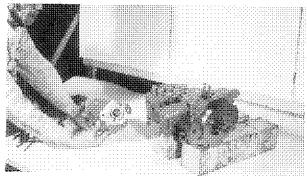
② O-ring

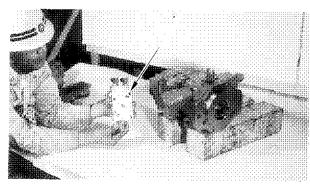
- 9. Separate LST pump block and port block.
  - 1 Valve plate: When reassembling, apply thin grease.
  - ② O-ring
  - 3 Mounting bolt: M12 x 35.

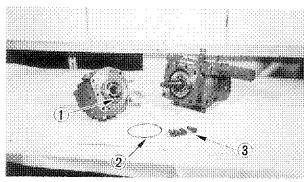
Torque:  $94.8 \pm 5.1$  ft-lb (13.1  $\pm$  0.7 kgf.m)

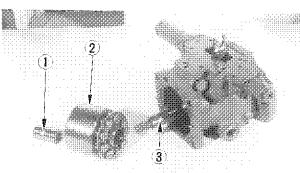
- 10. Take out cylinder block assy.
  - ① Collar
  - 2 Cylinder block assy
  - 3 Main shaft

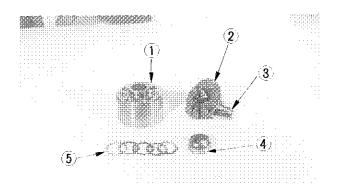


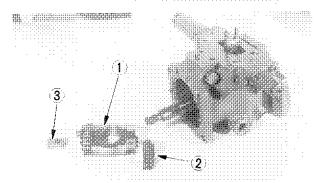


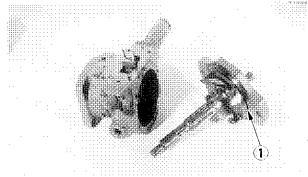


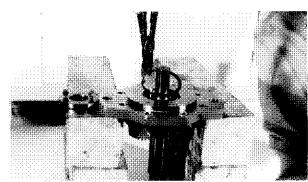


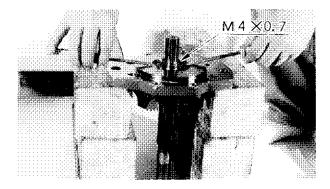












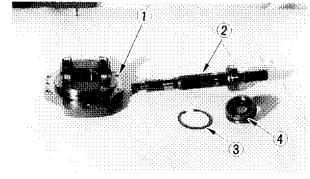
- 1 Cylinder block
- 2 Retainer plate
- (3) Piston assy
- 4 Retainer holder
- 5 Belleville spring
- 11. Take out swash plate
  - 1 Swash plate sub-assy
  - 2 Bearing
  - (3) Slide metal

- 12. Pull out main shaft
  - 1 O-ring
- 13. Take out snap ring.

14. Lift out oil seal case by using two screws and drivers.

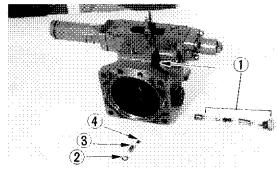
### 15. Tap out main shaft.

- 1) Flange assy
- 2 Main shaft
- 3 Snap ring
- (4) Oil seal case



## 16. Remove regulator-operate pressure compensating choke.

- (1) Pressure compensating choke
- 2 O-ring
- (3) Check seat
- (4) Poppet
- (5) Plug: Touque:  $28.9 \pm 1.4 \text{ ft-lb} (4 \pm 0.2 \text{ kgf-m})$



### 17. Remove regulator piston (Large dia side)

Regulator piston can be removed to large dia direction.

- 1 Nut: Tightening torque:  $72.3 \pm 14.5$  ft-lb (10 ± 2) kgf•m)
- (2) Cap
- 3 Mounting bolt
- (4) Air bleeding plug
- Stoppen
- 6 Spring
- ? Regulator piston
- 8 Stay
- 9 Bolt

<Note> Not (1) and stopper (5) should be adjusted at bench test.

> Special mark should be required if removing is necessary.

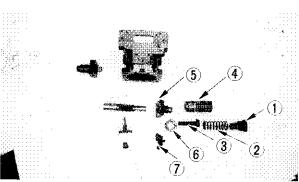
## 18. Remove regulator piston small end

(1) Plug

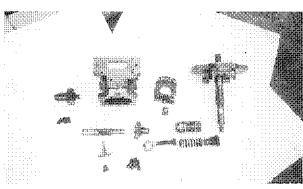
Tightening torque: 202.5 ~ 217.0 ft\*lb (28 ~ 30 kgf\*m)

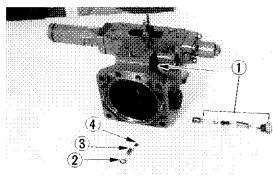
- (2) Spring
- 3 Spring seat
- 4 Adjuster
- (5) Cap
- (6) Nut

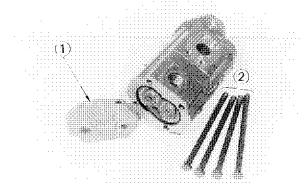
Tightening torque: 202.5 ~ 21.70 (28 ~ 30 kgf·m) Adjuster 4 and Not 6 should be marked when removing.

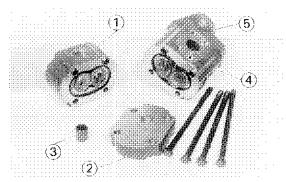


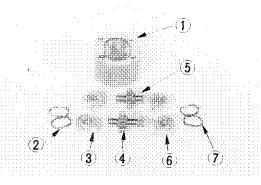
(7)

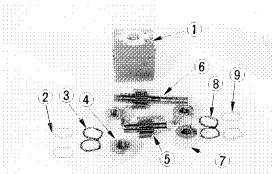










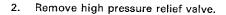


# d. Disassembly and reassembly of main pump and charge pump

- 1. Remove mounting bolts.
  - (1) Cover
  - $\bigcirc$  Bolts, Tightening torque: 37.6  $\pm$  3.6 ft-lb (5.2  $\pm$  0.5 kgf/cm<sup>2</sup>)
- 2. Separate main pump and charge pump.
  - 1 Charge pump assy
  - (2) Center plate
  - (3) Spline coupling
  - 4 Main pump
  - (5) Mounting flange
  - 1) Housing case (charge pump)
  - 2 Bushing seal
  - 3 Bushing
  - 4 Rear drive gear
  - 5 Driven gear
  - 6 Bushing
  - 7 Packin ring
  - 1 Housing case (Main pump)
  - 2 Backing ring
  - 3 Bushing seal
  - 4 Bushing
  - 5 Driven gear
  - 6 Front drive gear
  - (7) Bushing
  - 8 Bushing seal
  - (9) Backing

## e. Disassembly and reassembly of port block

- 1 Port block
- 2 LST pump side
- (3) LST valve sub-assy
- 4 Main plug, charge pump side
- (5) High pressure relief valve
- 6 P1 port
- 7 choke
- 1. Remove check valve.
  - 1) Plug
  - 2 Spring
  - 3 Poppet

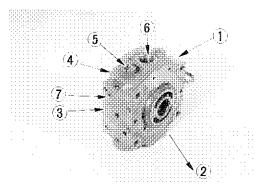


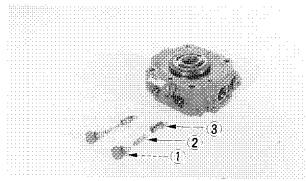
- 1 Poppet
- 2 Plug

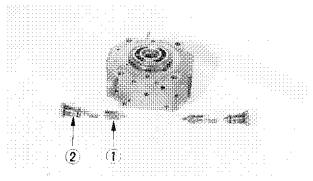
Tightening torque:  $86.8 \pm 4.3$  ft•lb (12 ± 0.6 kgf•m) **Note>** 

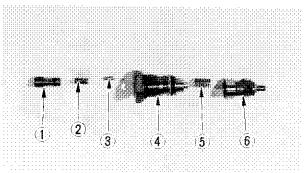
This high pressure relief valve is plugged after setting to 5335 psi (375 kgf/cm²) at bench test.

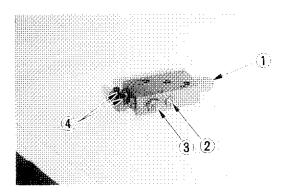
- 1 Adjusting screw
- 2 Spring B
- 3 Poppet B
- 4 Valve body
- 5 Spring A
- (6) Poppet A

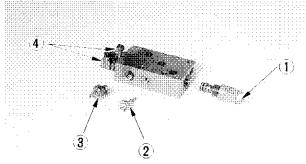


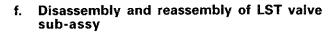




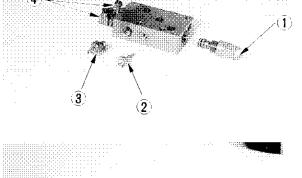




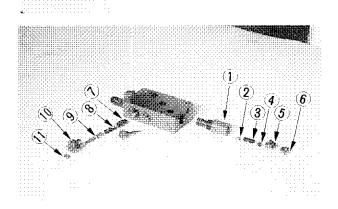




- 1 Low pressure relief valve
- 2 Variable orifice
- (3) Cut-off relief valve
- 4 L-bow (Temperature compensating choke)



1 Adjuster kit



- 1 Relief valve housing Tightening torque: 57.9 ~65.1 ft\*lb (8 ~ 9 kgf\*m)
- 2 Spring seat
- 3 Spring
- 4 Spring guide
- (5) Adjuster kit
- 6 Nut
- Tightening torque: 21.7 ~ 28.9jt•lb (3 ~4 kgf•m)

- Poppet
- 8 Spring
- 9 Adjuster
- 10 Plug

Tightening torque: 28.9  $\pm$  1.4 ft-lv (4± 0.2 kgf·m)

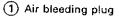
1 Nut

Tightening torque:  $2.97 \pm 1.45$  ft•lb (0.41 ± 0.2 kgf·m)

# g. Disassembly and reassembly of servo-regulator

- Servo-regulator
  - 1 Air bleeding plug
  - 2 Shock adjusting stopper
  - 3 Lock nut
  - 4 Neutral adjusting plug
  - (5) Lock nut
- 1. Remove servo-regulator spool assy.
  - (1) Spring
  - 2 Spring seat
  - 3 Control spool

Right and left hand spool should be identified.



Tightening torque:  $2.97 \pm 0.14$  ft·lb (0.41 ± 0.02 kgf·m)

2 Stopper (shock adjusting)

Lock nut tighteniung torque: 11.50  $\pm$  0.58 ft-lb (1.59  $\pm$ 

0.08 kgf·m)

(3) Plug

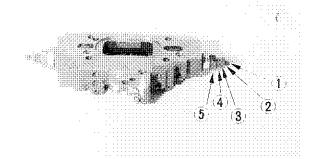
Lock nut tighteniung torque: 53.96± 2.68 ft•lb (17.46±

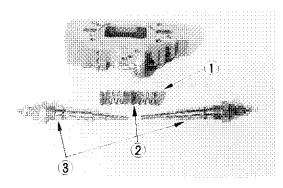
0.37 kgf·m)

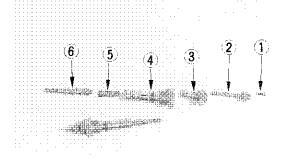
(4) Sleeve

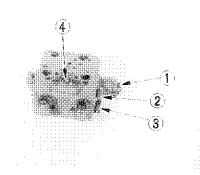
Nut tightening torque: 60.76 ft-lb (8.4 kgf-m)

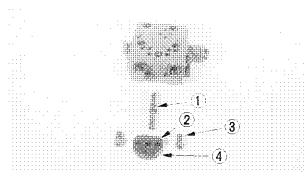
- (5) Spring
- (6) Spool

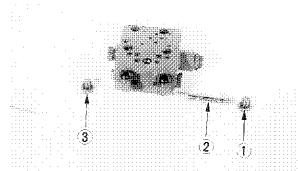


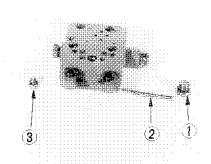


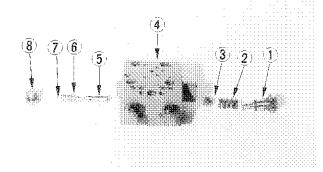












## h. Disassembly of regulator sub-body

## Regulator sub-body

- 1) Horse power control valve
- 2 Bush orifice
- 3 Start-up relief valve
- (4) Inching spool
- 1. Remove inching spool.
  - (1) Spool
  - (2) Plate
  - (3) Bolt; M8

Tightening torque: 23.9 ft-lb (3.3 kgf-m)

- (4) Gasket
- 2. Take out start-up relief spool.
  - (1) Plua

Tightening torque: 25.3 ~ 28.9 ft•lb (3.5 ~ 4 kgf•m)

- 2 Spool with orifice
- (3) Plug
- 3. (1) Plug

Tightening torque: 37.6 ~ 1.4 ft-lb (5.2 ~ 0.2 kgf-m)

- 2 Orifiu spool
- 3 Plug

Tightening torque: 10.8 ~ 14.5 ft-lb (1.5 ~ 2 kgf-m)

- 4. Remove horse power control valve.
  - Plug

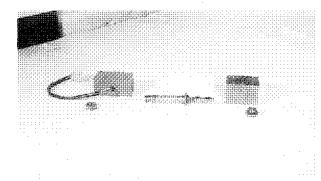
Nut tightening torque: 36.2 ~ 4304 ft-lb (5 ~ 6 kgf-m)

- 2 Spring
- 3 Spring seat
- (4) Sub-body
- (5) Spool
- 6 Bush
- 7 Rod
- (8) Plug

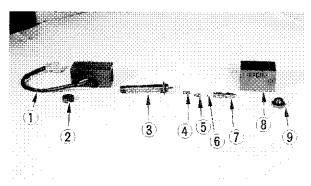
Tightening torque: 36.2 ~ 43.4 ft\*lb (5 ~ 6(

# i. Disassembly and reassembly of F-R solenoid valve

- 1. Remove nut and plug.
- 2. Separate solenoid case and valve case.

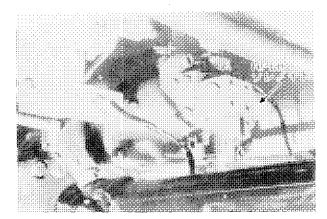


- 3. Remove inner parts.
  - 1 Solenoid case
  - 2 Nut
  - 3 Planger case
  - 4 Spring
  - 5 Liner
  - 6 Pin
  - Typool (7)
  - 8 Valve case
  - 9 Plug

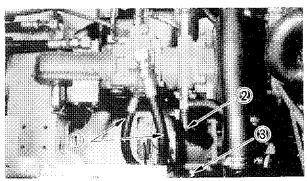


## j. LST motor removing and reinstalling

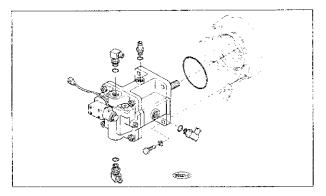
- Drain operating oil.
   Remove floor plate.
  - When starting engine after reinstallation, fill engine oil (SAE 10w-30) in the LST motor.



2. Disconnect Hi-Lo solenoid coupler.



- Disconnect two high pressure hoses.
   Disconnect return hose.
  - 1 LST motor ~ LST pump
  - (2) Case colling oil, LST motor ~ pump
  - (3) LST motor ~ oil cooler



- 4. Remove the mounting bolts while hanging the LST motor assy with wire sling.
- \* Get down the LST motor assy.

## <When reinstalling>

Apply thin grease on the LST motor spline shaft. Fit O-ring preperly.

## <When reassembling>

Tighten L-bow and adaptor with below tightening torque

PF 3/4 86.8 ~ 94.0 ft.lbs

 $\frac{1}{2}$ 

 $(12.0 \sim 13.0 \text{ kgf.m})$  PF 1/2  $43.4 \sim 47.0 \text{ ft.lbs}$ 

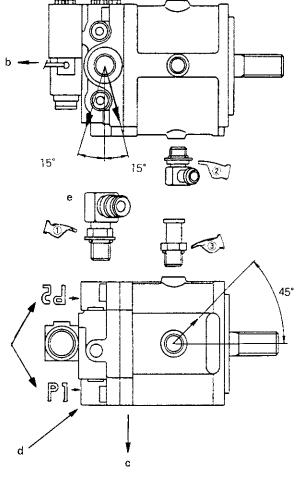
(6.0 ~ 6.5 kgf.m)

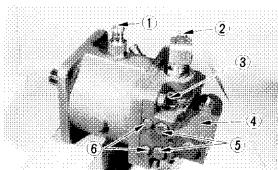
53

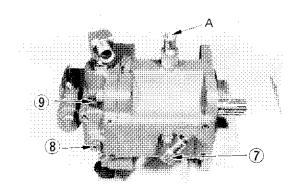
PF 1/2 86.8 ~ 101.2 ft.lbs

(12.0 ~ 14.0 kgf.m)

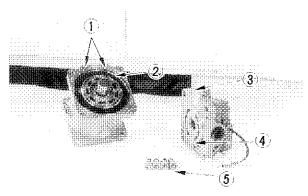
- a. Machine right side
- b. Machine front
- c. Machine lower side
- d. Lower elbow
- e. Upper elbow

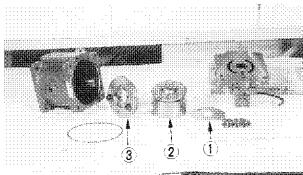


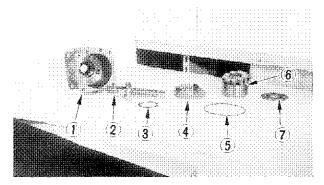


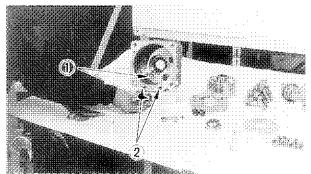


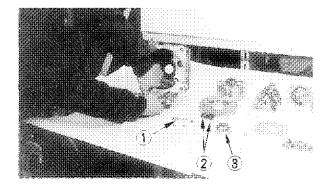
- 1 LST motor case cooling inlet
- (2) Looped line, pressurized to forward
- 3 Low pressure selector valve
- 4 Hi-Lo solenoid valve
- 5 High pressure gauge port
- 6 Check valve
- (7) To oil cooler
- 8 Bypass valve
- 9 Hi-Lo charge valve
- A: Fill case oil before starting











## k. LST motor disassembly and reassembly

- 1. Separate LST motor body and port block.
  - 1 O-ring
  - 2 O-ring
  - (3) Port block
  - (4) valve plate
  - (5) Mounting bolt: M14 x 35.

Torque: 130 ± 22 ft-lb (18 ± 3 kgf-m)

- 2. Take out valve plate, cylinder block, and swash plate.
  - 1 Valve plate
  - (2) Cylinder block assy
  - 3 Switch plate

- 3. Remove snap ring and take out main shaft.
  - (1) Motor case
  - (2) Main shaft
  - 3 Snap ring
  - (4) Swash plate
  - (5) O-ring
  - (6) Cylinder block
  - (7) Valve plate
- 4. Hi-Lo piston can be taken out with air blow through multi-layer orifice.
  - (1) Hi-Lo piston
  - 2 Multi-layer orifice inlet

(Air blow through multi layer crifice)

- 1 Plug assy (Multi-layer orifice)
- 2 Steel ball
- (3) Retainer holder

Multi layer orifice plug assy should be punched at two points on its circumference.

- 5. Disassemble bypass valve and check valve.
  - (1) Poppet —
  - 2 Spring Check valve
  - 3 Plug

Tightening torque: 12.7 ~ 1.8 ft-lb (1.75 ~ 0.25 kgf-m)

(4) Valve

Tightening torque: 7.23 ~ 0.72 ft•lb

 $(0.1 \pm 0.1 \text{ kgf·m})$ 

(5) Nut

Bypass valve

Tightening torque: 25.3 ~ 28.9 ft·lb -

(3.5 ~ 4 kgf·m)

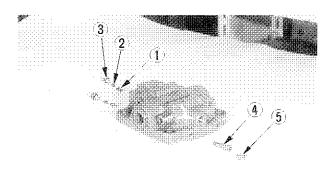
- 6. Disassemble low-pressure selector valve.
  - 1) Plug (Air bleeding)
  - 2 Plug

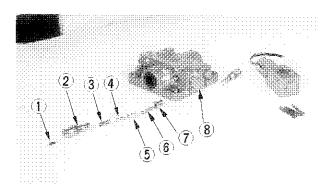
Tightening torque:  $39.8 \pm 3.6$  it lb ( $5.5 \pm 0.5$  kgf·m)

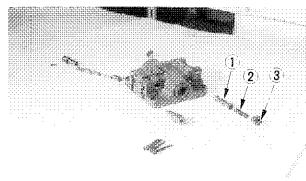
- (3) Spring
- (4) Spring seat (Check valve assy)
- (5) Bushing
- (6) Spool
- 7 Bushing
- 7. Disassemble Hi-Lo change valve.
  - 1) Spool
  - 2 Spring
  - (3) Plug

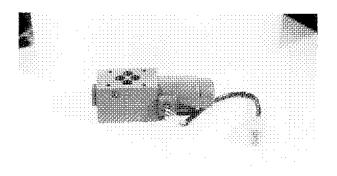
Tightening torque: 39.8  $\pm$  3.6 ft\*lb (5.5  $\pm$  0.5 kgf\*m)

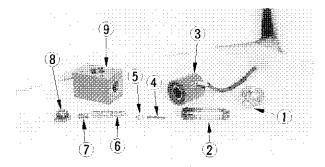
Be sewre the valve direction.









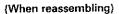


# I. Hi-Lo solenoid valve disassembly and reassembly

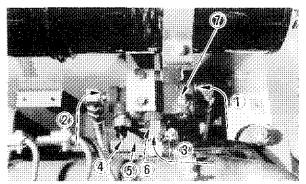
- 1. Remove cap.
- 2. Remove solenoid case.
- Dis assemble solenoid spool.
   check if foreign material or corner bur exist.
  - ① Cap
  - 2 Plunger case
  - 3 Solenoid case
  - 4 Pin
  - 5 Liner
  - 6 Spool
  - Spring
  - 8 Plug
  - 9 Valve case

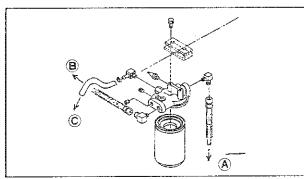
## m. Filter flange removal/reinstalling

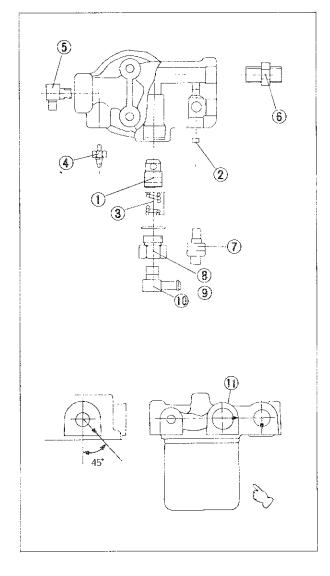
- 1. Remove pipings and hoses.
  - 3 To LST motor case
  - (2) To LST valve sub-assy, upper side
  - (1) From LST valve sub-assy, lower side
  - (5) 10 μ Filter cartridge (code: 68841 6228 -0)
  - (4) Pressure censer
  - (6) Bypass relief valve (193 psi, 13.6 kgf/cm<sup>2</sup>)
  - (7) Charge relief pressure gauge port
- Loosen mounting bolts to remove the filter flange assy. (When reassembling)
  - \* Be secure wireharness clamp position

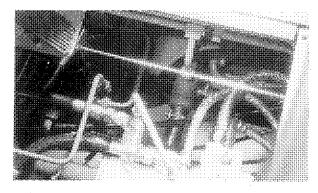


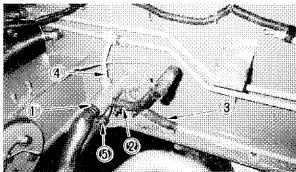
- 1) Insert the poppet and check its smooth motion.
- Check the free length of spring.
  Free length: 1.6 in. (41 mm)
  Total coil number: 10
- (3) Check the stamp P7 on oil switch.
- When tightening the filter cartridge, turn it 2/3 rotation by hand after contacting to seal surface.
- 6. Tighten the adapters and elbows correctly for its direction.
  - (1) Poppet
  - 2 Spring L = 1.61 in. (41 mm)
  - (3) O-ring
  - (4) Spring adapter
  - 5 Adapter elbow 1
  - 6 Elbow 1
  - (7) Plug
  - (8) Adapter
  - (9) Oil switch type: P7
  - (1) Adapter body
  - () Pressure gauge plug

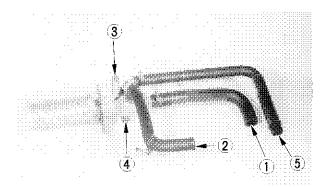












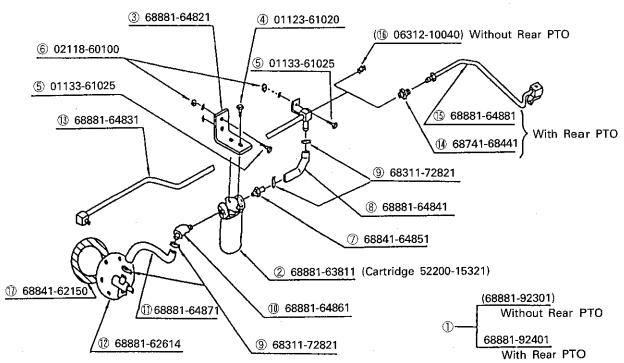
## n. Suction filter removal and reinstalling

- 1. Drain oil.
- 2. Loosen the hose clamps to disconnect hoses.
  - 1 Suction hose for main pump.
  - ② From bypass relief valve
  - 3 Return hose from oil cooler
  - 4 Return pipe from attachment
  - 5 Suction hose for charge pump
- Loosen mounting bolts and remove the suction filter assy.
   Note: Filter flange assy can be removed by loosening upper clamp of backhoe attachment.

(When reassembling)
Apply liquid packing and gasket.

- 4. Remove filter element
  - 1 Tank cover 2
  - 2 Suction filter
  - 3 Drain plug
  - 4 Sight gauge
  - 5 Tank cover 1

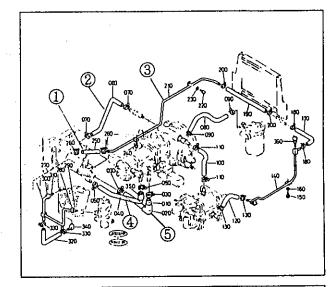
## O. Return filter installation

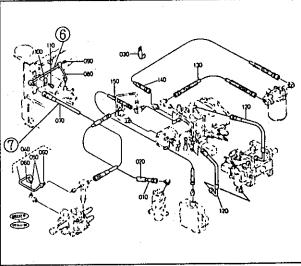




## Pay attention to safety.

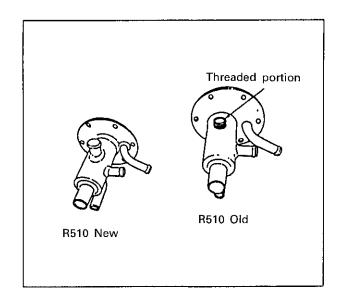
- ②Drain oil from the hydraulic tank.
- 2. Remove hoses and pipes.
  - ①Disconnect the hoses from tank cover 2.
  - ②Remove hoses and pipes ① to ⑦ in the figure at right.



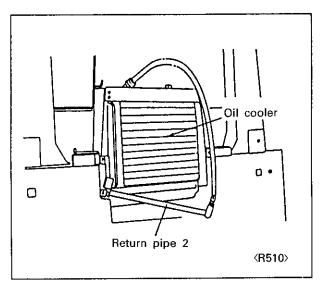


3. Remove tank cover 2 and the suction filter. <**Note**>

The difference between the new and old types of tank cover 2 in the case of the R510 shown at right is that the old type has threading foe pipe connection in the upper part.

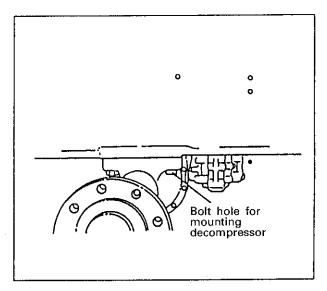


4. Remove return pipe 2 by pulling it backward.

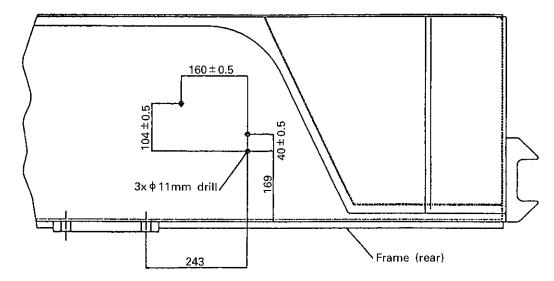


5. Drill the return filter mounting holes on the side face of the rear frame.

R510: Three  $\phi$ 11 mm holes The figure at right shows the case of the R510. See the next page for detailed dimensions.



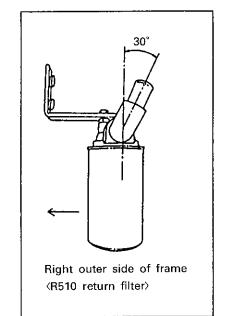
## (Drilling position)

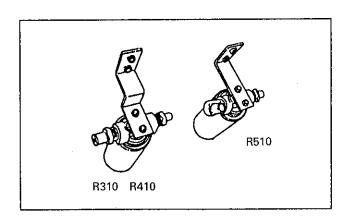


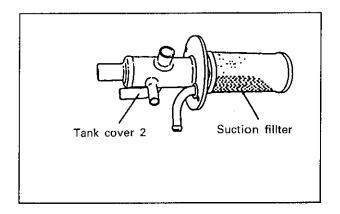
### 6. Install the return filter.

### (Note)

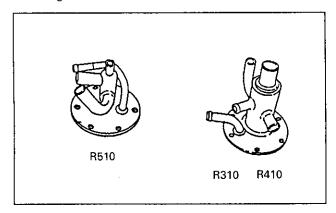
- ① In case of the R510, wrap sealing tape around the threaded portion of the elbow joint and install the return filter with an inclination of about 30°.
- When installing the filter element, coat oil on the gasket.
- 3 Tighten the element gradually. After the gasket comes into contact with the flange sealing face, manually tighten the element further by 3/4 turn.
- 4 Check any oil leak after trial operation.

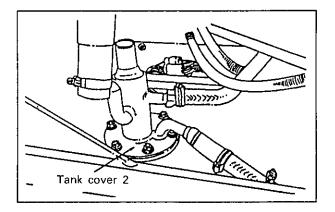






# 7. Install tank cover 2 after coating sealant on both sides of the gasket.





## 8. Connect the hoses and pipes.

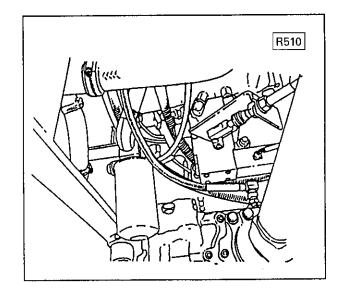
## ⟨Note⟩

- ① Carefully prevent contact between hoses.
- Pass return pipe 2 above the engine bracket when installing it.
- 3 In case of R510:

To avoid interference with return hose B, change the route of the return hose ( $\alpha$  in the figure) from the 10  $\mu$  filter flange to pass above the LST pump bypass hose ( $\beta$  in the figure).

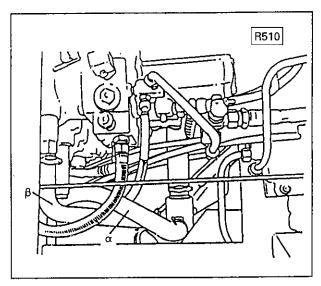
a: Return hose from 10 P filter flange

β: Bypass hose



## 9. Final check

Fill the specified amount of engine oil in the hydraulic tank. After idling a while, operate each hydraulic system and confirm no oil leak.



## Section III

# Power Train (Reduction gear, Differential, Axle)

## CONTENTS -

A.	Sp	ecification	III-01
	a.	Reduction gear case	
	b.	Differential and axle assy	
	c.	Propeller shaft	
	d.	Wheel and tire	
В.	Tro	publeshooting	III-03
C.	Tes	sting and adjustment (No description)	
D.	Se	rvicing	111-05
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	b.	Reduction gear case disassembling/ reassembling	III-07
	C.	Rear differential axle case disassembling	III-11
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	e.	Front differential axle case assy removing	III-21

# A. Specification A. Caractéristiques

## a. Reduction gear case

## a. Carter d'engrenage de réduction

Туре	Constant mesh, spur gear, two stage		
Туре	Prise constante, engrenage droit, deux étages		
Reduction ratio	$\frac{36}{23} \times \frac{43}{36} = 1.870$		
Rapport de démultiplication	$\frac{1}{23} \times \frac{36}{36} = 1.870$		
Lubrication	Engine oil 10W-30 / Gear oil M80B Common with rear differential		
Lubrification	Huile moteur 10W-30 / Huile engrenage M80B Compris avec le différentiel arrière		
Assy weight	66 lbs (30 kgf)		
Poids de l'ensemble			

## b. Differential and Axle assy

## b. Ensemble de différentiel et essieu

Reduction gear type	!	Spiral bevel gear			
Type d'engrenage de	e réduction	Engrenage conique spiral			
Axie type (Front/Rear)		Frame fixed, semi-floating	Frame fixed, semi-floating		
Type d'essieu (avan	t/arrière)	Fixé au châssis, semi-flottant			
Reduction ratio		$\frac{39}{8}$ = 4.875			
Rapport de démultip	olication	8 = 4.875			
Backlash adjustment	t method	Shim adjustment	Shim adjustment		
Méthode d'ajusteme	ent de battement	Ajustement par cale			
Available shim thick	ness	0.004, 0.008, 0.02 in (0.1, 0.2, 0.5 mm)			
Epaisseur de cale di	sponible				
Lubrication	Front	Engine oil 10W-30, 2.9 gal (11.0 ℓ )	Gear oil M80B 2.9 gal (11.0 $\ell$ ) )		
Lubrification	Avant	Huile moteur 10W-30	Huile engrenage M80B		
	Rear	Engine oil 10W-30/Gear oil M80B commun v	with reduction gear case		
	Arrière	Huile moteur 10W-30/Huile engrenage M80E de rèduction 3.0 Us gal (11.3 ½)	3 en commun avec le carter d'engrenage		
Weight Front Avant		407 lbs (185 kgf)			
Poids Rear Arrière		418 lbs (190 kgf)			
Planetary gear set		Sun gear: 13T, Planetary gear: 21T R	ing gear: 56T (56+13)/13 = 5.308		
Planetary					

## Backlash

### • Jeu de bottement

Spiral bevel gear — Drive pinion Engrenage conique spirale — Pignon d'entraînement 0.004 to 0.08 in. (0.1 to 0.2 mm)

## • Turning torque

## • Couple de tournage

Spiral bevel pinion assy only:  $1.08 \pm 0.14$  ft-lb (15  $\pm$  2 kgf.cm)

Ensemble de pignon conique spiral seulement

Differential and axle assy: 2.17  $\pm$  0.14 ft-lb (30  $\pm$  2 kgf.cm)

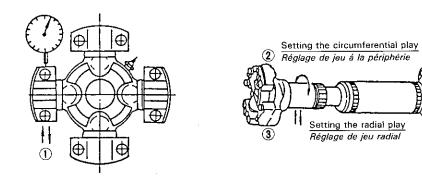
Ensemble de différentiel et essieu

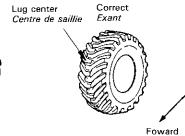
## c. Propeller shaft

## c. Arbre de transmission

Length Longueur	Min. 50in. (1270 mm) ~ Max. 53.7 in. (1363 mm)
Operating angle  Angle de service	22 degree degris
Assy weight Poids de l'ensemble	26.4 lbs (12 kgf)

ltem <i>Elément</i>	Reference value Valeur de référence	Service limit Limite de service
Play in the spider bearing  Jeu dans le roulement de croisillon	0 ~ 0.002 in (0 ~ 0.05 mm)	0.004 in (0.1 mm)
Circumference play in the spline Jeu de circonférence dans la connelure	0 ~ 0.006 in (0 ~ 0.15 mm)	0.012 in (0.3 mm)
Radial play in the spline  Jeu radial dans la connelure	0 ~ 0.008 in (0 ~ 0.2 mm)	0.020 in (0.5 mm)





Avant

## d. Wheel & Tire

## d. Roue et Pneu

Tire size	15.5/70-18-8PLY, Tubeless Sans chambre (Tubeless)
Taille de pneu	
Wheel size	18 x W13
Taille de roue	
Inflation pressure	$31.2 \pm 1.4 \text{ psi } (2.2 \pm 0.1 \text{ kgf/cm}^2)$
Pression de gonflage	
Max. tire load (one piece)	5412 lbs (2455 kgf)
Charge max. sur pneu (une pièce)	
Wheel tire assy weight	169.4 lbs (77 kgf)
Poids de l'ensemble roue pneu	
Tire replacement limit	Tire center rug wear: 0.59 in (15 mm)
Limite de remplacement de pneu	Usure centrale de pneu: 15 mm

- Hub bolt tightening torque
- Couple de serrage de boulon de moyeu
   M18 x 40 (9T): 203 ~ 234 ft. lbs (28~32.4 kgf·m)

## B. Troubleshooting

Symptom	Suspected cause	Remedy	Ref. page
a. Machine doesn't move	Negative brake always functions and can't be released.	Check brake and LST systems Check charge pressure	
	2. LST motor coupling spline york worn	Replace	
	Reduction gear case fails or stuck something in gears	Disassemble and check	III-07
	4. Differential/axle fails	Disassemble and check	III-11
b. No driving on front or	Propeller shaft fall down	Check and reinstall	III- 07
rear axle	2. Front or rear differential fails	Remove and check	III-11,14
	3. Axle fails and doesn't transfer torque	Remove and check	III-11
c. Drive train has too much	Tire and wheel mounting bolts too loose	Check and retorque	III-02,21
slop	Propeller shaft mounting bolts are loose	Check and tighten	III-07
	Differential backlash too large	Readjust or renew	III-01,20
	Axle retaining nut is loose	Disassemble and tighten	III-12
d. Noisy reduction	Insufficient oil level	Add oil	III-01,05
gear/differential	2. LST motor mounting bolts are too loose	Check and tighten	III-07
	3. Foreign metal particle intruded	Disassemble and check	III-07
	4. Spiral bevel pinion shaft became loose	Disassemble and check	III-01,17
	5. Spiral bevel ring gear worn	Replace	III- 19,20
	Axle retaining nut became loose	Check and tighten	III-12
Growl, hum or grinding noise	7. Gear worn or damaged	Replace	III-18,19
Hiss, thump or bumping noise	8. Bearing worn or damaged	Replace	- 17
Squeal noise	9. Gear or bearing seizure	Replace	III- 17
e. Oil leaks from reduction	Case gasket is damaged	Replace	III-09
gear case	2. Oil seal worn or damaged	Replace	III- 12
	3. O-ring worn or damage	Replace	III-08,12
	Misassembling of knock pin	Disassemble and renew	III- 09
	5. Gear case surface isn't tightened properly.	Remove and reassemble	III-09
f. Oil leaks from	1. Fill-in plug is loose	Seal and tighten	III-05
differential/axle	2. Cover mounting bolts are loose	Tighten	III- 07
	3. Oil seal worn or damaged	Replace	III- 12
	4. Gasket damaged	Replace	III-O9
	5. Axle retaining nut is loose	Disassemble and tighten	III-12

Symptom	Suspected cause	Remedy	Ref. page
g. Propeller shaft vibrating	Universal joint bearing damaged	Replace parts	III-02
	2. Propeller shaft deflected	Repair or replace	III-02
	3. Spline worn	Replace	III-02
	4. Loose mounting bolts	Retighten	III- 07
	5. Wrong direction of yoke	Reinstall	III-05
h. Propeller shaft knocking	1. Loose mounting bolts	Retighten	III- 05
in starting-up or noise in jigzag traveling	2. Wrong direction of yoke	Reinstall	III-0 <b>5</b>
Jigzag Haromig	3. Spline worn	Replace	III-02
	4. Universal joint worn or damaged	Replace	III-02
i. Propeller shaft fall down	Flange mounting bolts damaged	Check and renew	
	2. Yoke mounting bolt damaged	Renew	
	3. Propeller shaft sliding stuck	Remove and grease	
	4. Too much machine vibration	Check reduction case/ differential/axle/engine mounting bolts	III- 06
	5. Hit with hard rock	Check and reinstall	
j. Tire/wheel is coming off	1. Hub boits are loose	Check and retighten	III-02,06
	2. Axle cover mounting bolts are loose	Tighten	III-11,12
	3. Axle retaining bolt is loose	Tighten	III- 11,12
k. Flat tire too often	Too much heavy load is applied	Check to the specifications	
	Tire pressure isn't proper	Check pressure	III-02,21
	3. Something sharp edge stuck in tire	Remove	
	Application (working condition) isn't recommendable	Use as recommended	
	5. Air intake valve is damaged	Replace	
	6. Wheel has distortion	Check and replace	

## D. Servicing

## a. Reduction gear case and differential axle removing/reinstalling

1. A B

Be sure to set the articulate lock bar

2. Loosen the drain plug to drain oil.

(When reassembling)

Oil amount: 3.0 gal (11.3 1)

Check oil level at oil feed plug on differential case. Reduction gear case and differential axle has common

oil sump. <Note>

It needs to feed oil after mounting the propeller shaft, or oil may drain out.

3. Remove the rear propeller shaft.

(When reassembling)

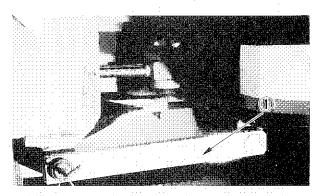
Mounting bolt: M 12 x 25 (7T)

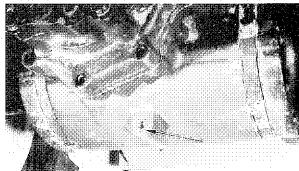
Tightening torque: 57.1 ~ 66.5 ft.lbs (7.9 ~ 9.2 kgf.m)

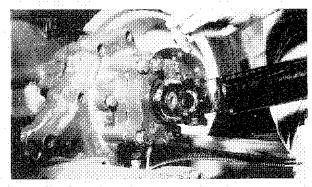


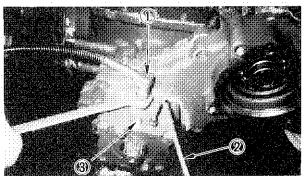
- 4. Disconnect the brake piping at the negative brake case side.
  - 1 From charge pump
  - (2) From master cylinder
  - (3) Air bleeding nipple

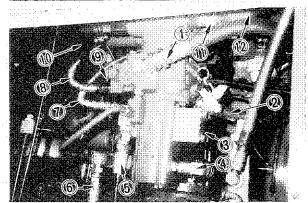
- 5. Disconnect hoses.
  - 1 High pressure hoses between LST pump ~ LST motor (2 pcs)
  - (2) Return hose 1 between LST pump ~ LST motor (1 pc)
  - 3 Return hose 2 between LST motor ~ oil cooler (1 pc)

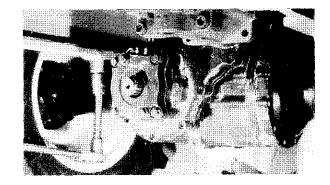












 Support the rear differential case with garage jack and remove the axle mounting bolts. (When reinstalling)

Bolt	M24 x 80 (7T)
Tightening torque	398 ~ 412 ft.lbf
	(55 ~ 57 kgf.m)

Apply screw lock-tight

7. Pull the differential axle/reduction case assy out after lifting up the rear frame.

(When reinstalling tire)

Hub bolt	M18 x 40 (9T)
Tightening torque	203 ~ 234 ft.ibf
	(28 ~ 32.4 kgf.m)
Air pressure	31.2 ± 1.4 psi
	$(2.2 \pm 0.1 \text{ kgf/cm}^2)$



Support the machine body with a stand for safety.

## Reduction gear case disassembling/ reassembling

Detach the LST motor assy.
 (When reinstalling)
 Apply thin grease on the spline shaft.
 Securely fit O-ring without twisting.

Bolt: M14 x 40 (7T) Tightening torque:

2. Take off the propeller shaft.

Note: O-ring is fitted. (When reinstalling) Apply thin grease on oil seal lip and O-ring.



When removing and reinstalling the reduction gear case, hang it with wire sling.

3. Remove brake cover.

(When reinstalling)

Apply grease on both outer separator plate and brake cover and put together to prevent the plate from falling down.

 Care should be taken if separater plate fits properly when reinstalling.

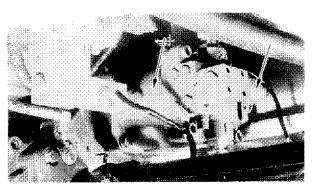
Tightening torque:

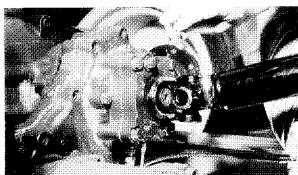
57.1 ~ 66.5 ft.lbs

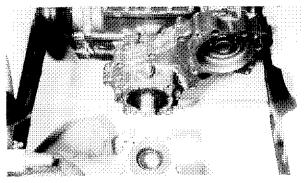
(7.9 ~ 9.2 kgf.m)

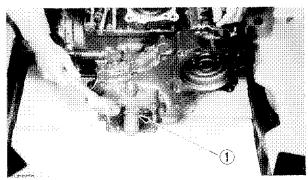
- Use liquid gasket on both sides of cover packin.
- 4. Remove snap wire.

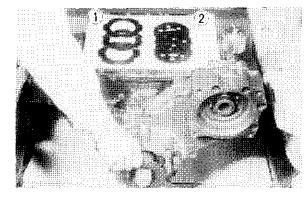
Photo shows installation of snap wire  $\hat{\mathbb{T}}$ .

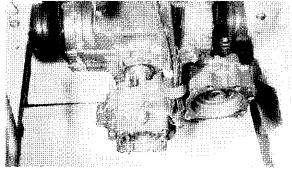


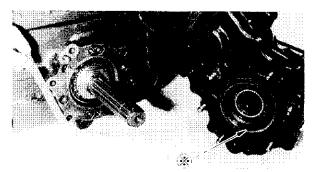


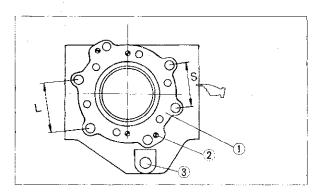












- 5. Take off the separator plates and friction plates.
  - (1) Separator plate

Thickness t =  $0.122 \pm 0.004$  in. ... 4 pcs.  $(3.1 \pm 0.1 \text{ mm})$ 

Plate warp allowable limit: 0.006 in. (0.15 mm)

2 Friction plate (3 pcs)

Reference thickness	0.152 ± 0.004 in
	$(3.85 \pm 0.1 \text{ mm})$
Service limit	One side wear
	0.004 in. (0.1 mm)

(When reassembly)

Apply engine oil SAE10W30.

6. Unscrew the connecting bolts and separate the reduction gear case assy from differential.

Carefully tap with rubber hammer.

(When reinstalling)

Mounting bolts pitch should be mated as shown in photo. Fit O-ring and apply grease.

Tightening torque:

46.3 ~ 53.5 ft.lbs

(6.4 ~ 7.4 kgf.m)

\* O-ring

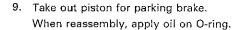


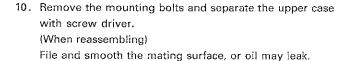
Distances S: 3.0 in. (75 mm)

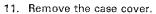
- Bearing holder
- 2 Knock pin
- 3 Drain port

- 7. Take out negative brake releasing pin (1).
  - ① Pin (2 pcs) ø8 x 40 mm
  - 2 O-ring

Remove piston retainer. Caution! Spring may pop out.

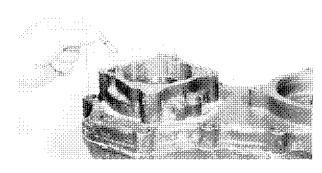


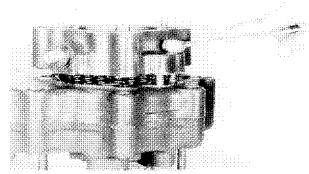


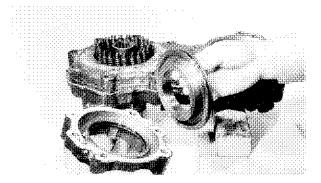


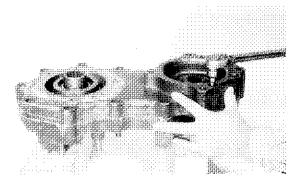
(When reassembling)

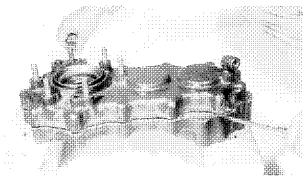
- Note the gear boss direction.
- Apply liquid gasket on both sides of packing.
- Bolt: M10 x 45, 7T 48.0 ~ 55.9 N.m (35.4 ~ 41.2 ft.lbf, 4.90 ~5.70 kgf.m)

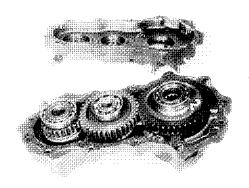


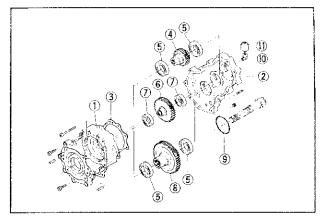












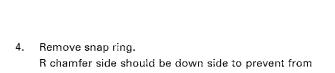
- 12. When reassembly, check boss direction of gear.
  - <!nner parts>
  - 1 Reduction gear case 1
  - 2 Reduction gear case 2
  - 3 Gasket
  - 4 24T gear
  - (5) Ball bearing
  - 6 36T gear
  - Ball bearing
  - 8 43T gear
  - 9 O-ring
  - Adapter
  - 1 Breather

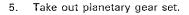
## c. Rear differential axle case disassembling

 Remove axle case mounting bolts and carefully tap with hammer to remove.

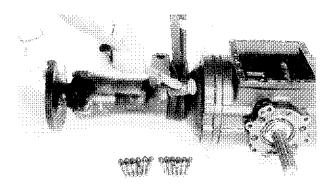
Keep it suspended with wire or nylin sling as shown in photo.

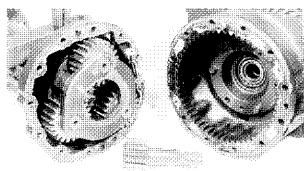
- 2. Place the differential axle case assy on wooden blocks Remove cover and packing.
- 3. Remove right and left axle cases.

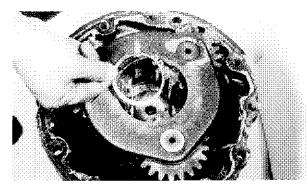


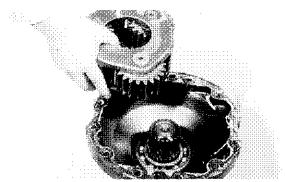


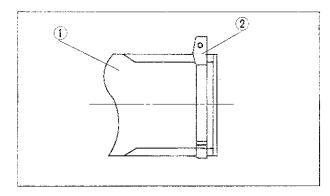
1 Axle shaft 2 Snap ring

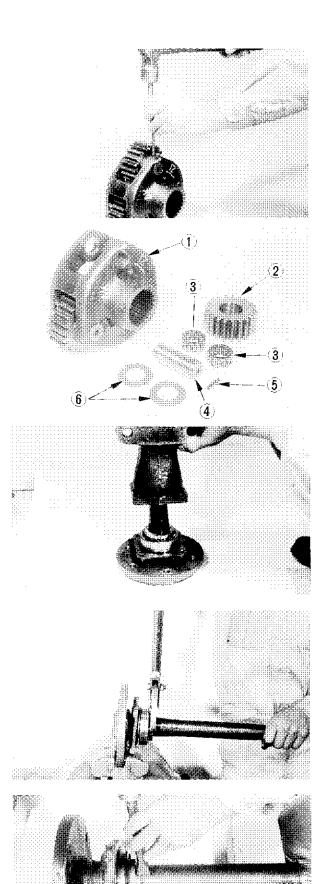












6. Punch out spring pin.
When reassenbktm slit of spring pin should be vertical to

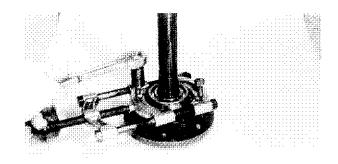


- 1) Planetary carrier
- (2) Planetary gear
- (3) Needle bearing
- (4) Pin
- 5 Spring pin
- 6 Thrust coller
- 7. Separate axle case from axle shaft.

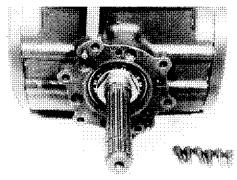
Take up the nut ring and remove bearing nut.
 (When reassembling)
 Securely install the ball bearing into axle shaft and tighten nut completely.
 (When reassembling)
 Bend nut ring with axle groove properly.

<Note> If nut ring has any damage, replace with new one.

- 9. Pull out ball bearing from axle shaft.
- 10. Take out special oil seal if necessary.



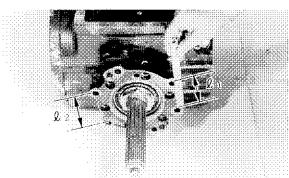
11. Remove the mounting bolts and take out the spiral bevel pinion assy.



(When reinstalling)

Mounting bolts pitch should be as shown in photo.

£1 = 2.91 in (74 mm)£2 = 3.43 (87 mm)



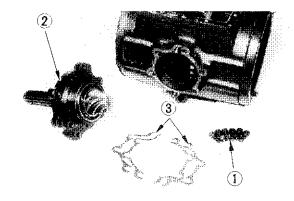
- 1 Mounting bolt
- 2 Spiral bevel gear assy
- 3 Shim

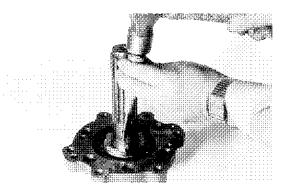
Available:

0.004, 0.008, 0.02 in

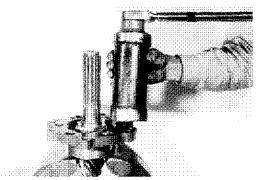
(0.1, 0.2, 0.5 mm)

Ordinary installed shim thickness in factory. 0.004 in. (0.1 mm)  $^{\circ}$ 



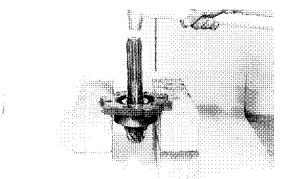


12. Straighten the bearing washer tongue.

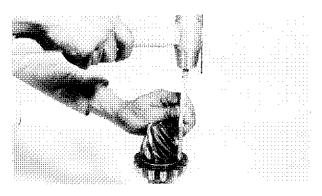


13. Loosen the bearing nut by using special box wrench shown in photo.

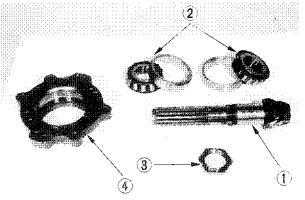
Wrench size: 2.36 in. (60 mm)



14. Press out shaft (with copper hammer).



15. Punch out the tapered roller bearing.



- (1) Spiral bevel pinion
- 2 Tapered roller bearing
- 3 Nut
- 4 Bearing cover

16. Remove mounting bolts of bearing support and pull it out

Use same thickness shims removed and adjust finally.

- 1 Bearing support
- 2 Pull-out bolts

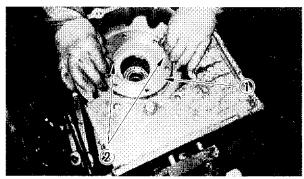
(When reassembly)

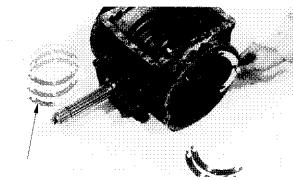
① Shim Available: 0.004, 0.012, 0.02 in. (0.1, 0.3, 0.5 mm)

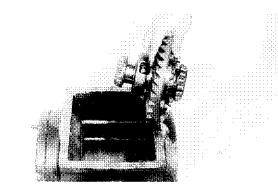
17. Take out spiral bevel gear and differential. (When reassembly) Install the knock pin into the spiral bevel gear. No gap is required between mating surface. Tighten the UBS bolts to specified torque. UBS bolts: M10x25

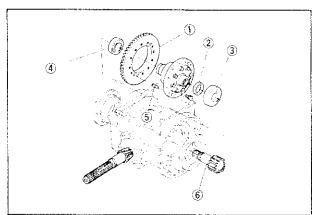
Torque: 68.7 ft.lbs (9.5 kgf.cm)

- Apply lock-tight.
- 1 Bevel gear 39T
- (2) Collar
- 3 Tappered roller bearing
- 4 Tappered roller bearing
- (5) Knock pin
- 6 Gear left, 13T







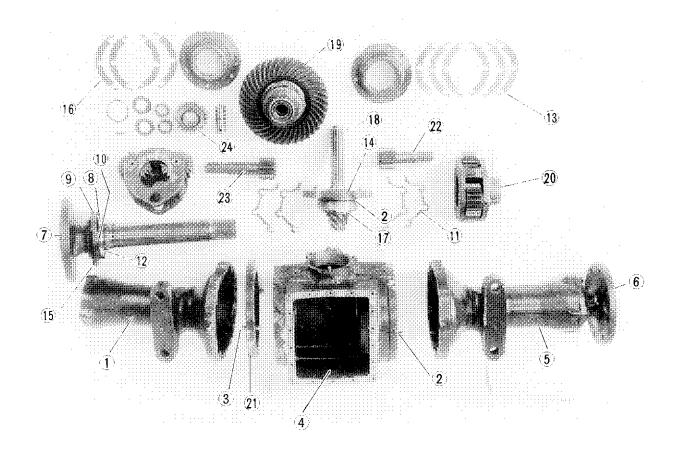


## d. Reassembling of rear differential axle case

Reassembling procedure is the reverse of disassembling, but pay special attention on shim adjustment, turning torque and backlash adjustment.

## d. Remontage du différentiel arrière/essieu

La procédure de remontage est l'inverse de la procédure de démontage, mais faire particulièrement attention à l'ajustement de cale, au couple de Rotation et à l'ajustement du jeu de battement.



- (1) Axle case 1 Carter de axle 1
- (2) O-ring

  Joint torique
- (3) Straight pin Axe de centrage
- (4) Differencial case Carter de diff.
- (5) Axie case 2

  Carter d'essieu 2
- (6) Axle 2 Essieu 2
- (7) Axle 1 Essieu 1
- (8) Oil seal Bague joint
- (9) Cover Couvercle
- (i) Ball bearing Roulement a billes
- III-16 Shim

- (2) Bearing nut Ecrou de roulement
- 13 Shim Cale
- (4) Bearing holder Support d'engrenage
- (5) O-ring Joint torique
- (16) Shim Cale
- (i) Taper-roller bearing Roulement
- (8) Rear bevel pinion, 8T Pignon d'attaque
- Spiral bevel gear, 39T
  Pignon d'attaque
- Planetary gear set Jeu d'engrenage planétaire
- (1) Internal gear, 56T Engrenage interne,56D
- (2) 13T gear, left
  Engrenage gauche 13D

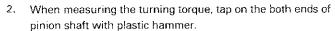
- 13T gear, right Engrenage droite 13D
- 24 Planetary gear Engrenage planétaire

 Set the dummy bolt at shaft end to measure turning torque.

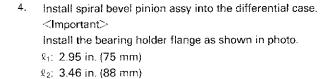
#### <Reference value>

 $1.08 \pm 0.14$  ft.lb (15  $\pm$  2 kgf.cm)

1 Turning torque gauge
Bearing must be dry condition when measuring.



- Repeat steps 4, 5, and 6 to get reference value.
- (2) Dummy bolt
- 3. Bend bearing nut to tabs after turning torque is reference value.

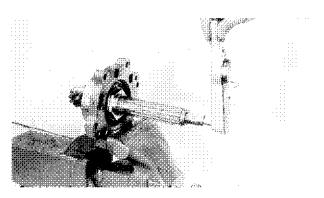


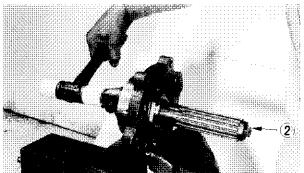
 Insert shims tentatively same thickness as disassembling.
 Shim thickness inserted in factory: 0.004 in. (0.1 mm)
 Pay attention to shim direction.

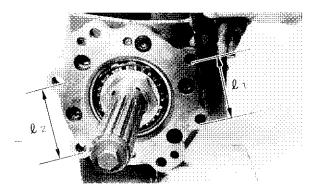
6. Tighten the mounting bolts to specified torque.

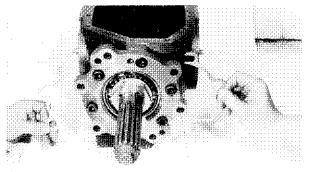
Bolt size: M12 × 25

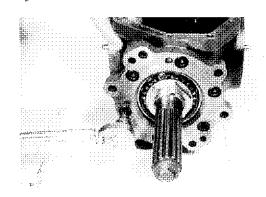
Tightening torque: 61.5 ft.lbf (8.50 kgf.m)

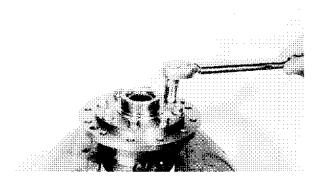


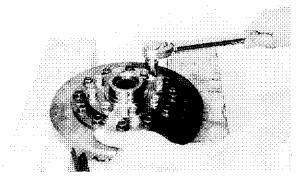


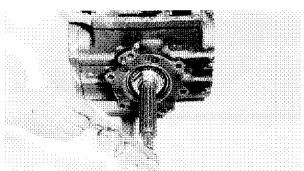


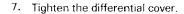












Bolt size: M10 × 25 (7T)

Tightening torque:  $35.4 \sim 41.2$  ft.lbf ( $4.9 \sim 5.7$  kgf.m)

Install the knock pin and the spiral bevel gear.
 No gap is required between mating surface.
 Tighten the UBS bolts to specified torque.
 68.7 ft.lbf (9.5 kgf.m)
 Apply lock-tight.

#### 9. Insert the shims.

- Tentativel, use same thickness of shims as originally installed and need final adjustment.
- Shim thickness installed in factory.

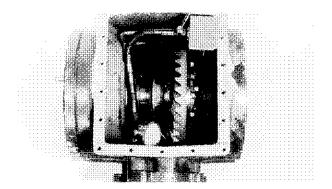
in. (mm)

Right side	Left side
0.024 ~ 0.031	0.004 ~ 0.008
(0.6 ~0.8)	(0.1 ~0.2)

#### <Turning torque>

 $2.17 \pm 0.14$  ft.lb (30 ± 2 kgf.cm)

Measure turning torque at the pinion shaft without oil seal.

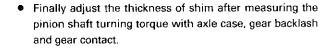


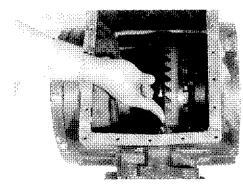
10. Check gear backlash.

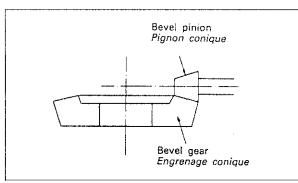
Backlash measured at any 3 points on all teeth of bevel gear must be within specified value.

Specified value: 0.004 in to 0.008 in (0.1 to 0.2 mm)

- 11. Check contact between spiral bevel pinion and bevel gear. Dissolve the red lead in oil. Apply it thinly over several teeth of the 5th-shaft bevel pinion and turn the pinion to check how the red lead is transferred to the gear.
  - The contact between the spiral bevel gear and the pinion must be 2/3 or more of the total contact width.







## Contact between spiral bevel pinion and bevel gear Contact entre le pignon conique en spirale et l'engrenage conique

Correct	Backlash	0.004 to 0.008 in,	
Correct	Jeu de battement	0.1 à 0.2 mm	
	Tooth contact  Contact des dents	Annununununun )	
Tooth tip contact  Contact par les pointes des dents	A MATTER AND A MAT	Teeth engagement is shallow and only the teeth tips contact.  L'engagement des dents est peu profond et seules les pointes entrent.	Remove the shims in the right side of the differential case bearing holder and insert shim of the same dimension to the left side.  Retirer les cales du côté droit du support de palier du carter du différentiel et mettre des cale de la même dimension au côté gauche.
Tooth root contact Contact par les racines des dents		Teeth engagement is deep and only the teeth roots contact.  L'engagement des dent est profond et les racines des dents entrent en contact.	Remove the shims in the left side of the differential case bearing holder and insert shim of the same dimension to the right side.  Ratirer les cales du côté gauche su support de palier du carter du différentiel et mettre des cale de la même dimension au côté droit.
Small-end contact Contact par les petites extrémités		Pinion gear engagement is shallow and only the smallends contact.  L'engagement de l'engrenage à pignon est peu profond et seules les petites extrémités entrent en contact.	This occurs when the bevel pinion has smaller allowance than the bevel gear has. To adjust, remove the shims in the pinion side and shift the bevel pinion shaft towards the differential. Simultaneously, the bevel gear must be moved the right side to keep the backlash contact.  Un tel phénomène survient lorsque le pignon conique a une tolérance plus petite que l'engrenage conique. Pour régler, retirer les cals sur le côté du pignon et déplacer l'arbre du pignon conique vers le différentiel. Simultanément, déplacer l'engrenage conique vers le côté droit de manière à conserver le jeu de battement.
Large-end contact Contact par les grandes extrémités		Pinion gear engagement is deep and only the large-ends contact.  L'engagement de l'engrenage à pignon est profond et les grandes extrémités entrent en contact.	This occurs when the bevel pinion greater allowance than the bevel gear has. To adjust, add shims to the pinion shaft to keep it away from the differential. Simultaneously, the bevel gear must be moved to the left side to keep the backlash constant.  Un tel phénomène se produit lorsque le pignon conique a une tolérance plus grande que l'engrenage conique. Pour régler, ajouter des cales à l'arbre de pignon pour le maintenir à l'écart du différentiel. Simultanément, déplacer l'engrenage conique vers la gauche pour maintenir le jeu de battement.

### e. Front differential axle case assy removing

Disassembling and reassembling of internal parts are basically same as the front differential axle assy.

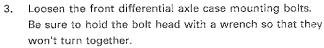
Be sure to set the articulate lock bar. Apply block to prevent rotation of the tire.

1. Drain oil.

(When reassembling)

Engine oil 10W 30: 2.9 gal (11.0 f)

2. Remove flange mounting bolts to draw out propeller shaft.



Bolt: M24X (7T)

Tightening torque: 398 ~ 412 ft.lb

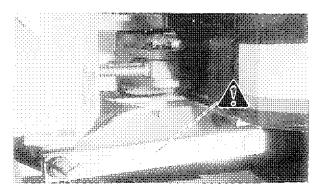
(55 ~ 57 kgf.m)

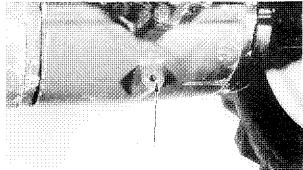


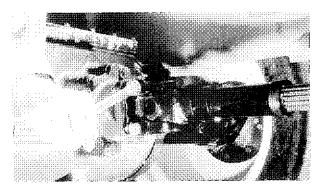
AND AND AND AND AND AND AND AND AND AND	R510
Hub bolt	M18 x 40 (9T)
Tightening torque	203 ~ 234 ft.!bf
	(28 ~ 32.4 kgf.m)
Air pressure	31.3 ±1.4 psi
	$(2.2 \pm 0.1 \text{ kgf/cm2})$

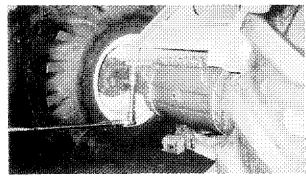
- 1 Hub bolt
  2 Belleville spring
  3 Oil seal
  4 Ball bearing

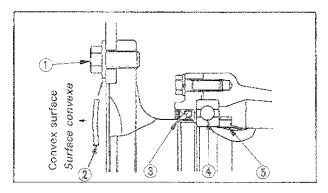
- (5) Bearing nut











# Section IV

# **Brake System**

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## A. Specification

## A. Caractéristiques

### a. Brake performance

### a. Performance du frein

- 1. Service brake performance (with backhoe)
- 1. Performance du frein de service (avec pelle rétrocaveuse)

		R510 (B)
Pedal treading force Force de pédale	Inching Avance au pas	13.2 lbs (6 kgf.)
	Full braking Freinage complet	78.9 lbs (35.8 kgf)
Pedal operating stroke Course de	Inching stroke Course d'avance au pas	1.57 in. (40 mm)
fonctionnement de pédale	Braking stroke Freinage complet	0.79 in. (20 mm)
Braking capacity Capacité de freinage	2 post Rops/Cab	3075 lbs (1395 kgf)/3260 lbs (1480 kgf)
Braking distance Distance de freinage	16.4 ft (5 m) >	
Braking distance only dyr Distance de freinage avec	namic brake frein dynamique seulement	F.H.: 13.1 $\pm$ 1.6ft (4.0 $\pm$ 0.5 m), FL: 3.3 $\pm$ 1.6 ft (1.0 $\pm$ 0.5 m)
Master cylinder rod play  Jeu de tige de maître-cylindre		0.04 ~ 0.08 in. (1 ~ 2 mm)

#### 2. Parking brake performance

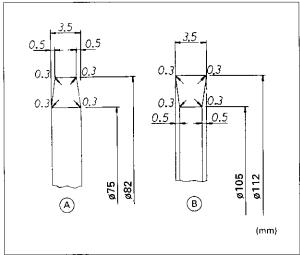
#### 2. Performance de frein de stationnement

	R510 (B)
Braking capacity 2 post Rops/Cab  Capacité de freinage	1575 lbs (715 kgf)/1675 lbs (760 kgf)
Braking capacity on the slope (Engine stop)  Capacité de freinage sur pente (Frein moteur)	15° or more ou plus

- 3. Negative brake releasing pressure: 128 psi (9 kgf/cm²)
- 3. Pression de dégagement du frein négatif:

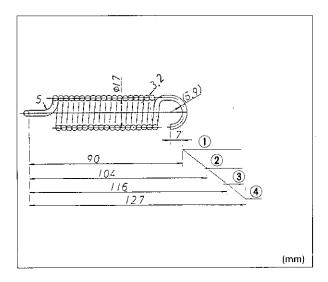
#### b. Brake oil Reserve tank capacity 0.28 ℓ (0.07 us gal) b. Huile de frein \_4° 14° 32° 50° 68° 86° 30°C 40°C 20° 0° 10° -20° -10° Hydraulic oil ISO VG32 Service brake line Huile hydraulique ISO VG32 Conduite de frein de service **SAE 10W30** Parking brake line Engine oil SAE 15W40 Conduite de frein de stationnement Huile moteur SAE 30W SAE 10W IV-01

- c. Brake inner parts dimensions
- c. Dimensions des pièces internes du frein



\$ 8.8

(mm)



- 1. Brake seal
- 1. Joint de frein
  - A Brake seal 1

    Joint de frein 1

    68881-1526-0
  - B Brake seal 2

    Joint de frein 2

    68881-1527-0

Max. allowable oil temp.

Température d'huile max. admissible
212°F (100°C)

Max. Operating pressure

Pression de fonctionnement max.

853.4 psi (60 kgf/cm²)

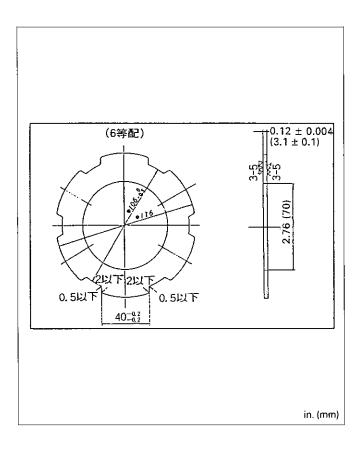
- 2. Spring
- 2. Ressort

	68841-1563-0	68841-1564-0
ltem	© Spring 1	D Spring 2
Elément	Ressort 1	Ressort 2
Spring rate	85.62 lbs/in.	19.71 lbs/in.
Taux de ressort	(1.592 kgf/mm)	(0.352 kgf/mm)
Set length	1.06 in.	
Longueur réglée	(27 mm)	
Set force	45.6 lbs	19.2 lbs
Force réglée	(20.7 kgf)	(7.8 kgf)
Spring operating stroke Course de fonctionnement de ressort		
Course de foricilorinement de ressort		

- 3. Return spring (C/N 68841-3213-0)
- 3. Ressort de rappel
  - 1 Initial force: 8.82 lbf (4 kgf) Force initiale: 4 kgf
  - (2) Installing load: 43.00 lbf (19.5 kgf) Charge d'installation: 19,5 kgf
  - (3) Operating load: 72.31 lbf (32.8 kgf) Charge de fonctionnement: 32,8 kgf
  - (4) Max. load: 99.19 lbf (45.0 kgf) Charge max.: 45,0 kgf

(C)

(D)



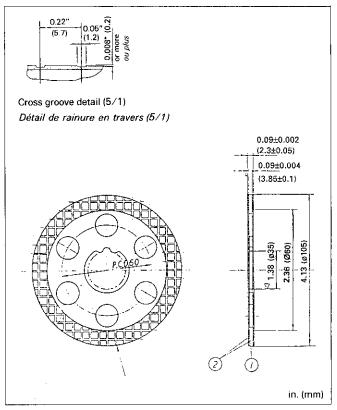
4. Separator plate: 68881-1523-0

4. Plaque de séparation

Material: \$450 ~ \$550
 Matériel: \$450 ~ \$550

• Service limit Limite de service

Warp: 5.91 in. (0.15 mm) below Voile: moins de 0,15 mm



5. Friction plate: 68881-1524-0

5. Plateau de friction

Core plate material: S45C
 Matériel de composition du platecee: S45C

Lining material: Paper type
 Matériel de garniture: Type papier

Service limit: Until lining cross groove disappears.
 Approx. 0.008 in. (0.2 mm) one side.

Limite de service: Jusqu'à ce que la rainure en travers de la garniture disparaisse. Approx. 0,2 mm d'un côté

1 Core plate Plateau

② Lining Garniture

# B. Troubleshooting

Symptom		Suspected cause		Remedy	Ref.
a.	Service brake malfunction	1.	Air intrusion or insufficient air bleeding	<ul> <li>Check and replenish the brake oil.</li> <li>Check oil leakage from reserve tank or piping.</li> <li>Bleed air.</li> </ul>	IV-10
		2.	Master cylinder oil leakage	Check piston seal	IV-10
		3.	Friction plate worn	Check and replace	IV-O3, 13
		4.	Separator plate worn or warp.	Check and replace.	IV-03, 13
		5.	Brake seal 1 or 2 damage.	Check and replace.	IV-02, 14
b.	Service brake pedal doesn't return.	1.	Return spring damage or removed.	Check and reinstall or replace.	IV-O2
C.	Service braking pedal is heavy.	1.	Piston seal 1, 2 damage	Check and replace.	IV-14
		2.	Unspecified oil usage	Renew oil,	IV-01
d.	Parking brake malfunction	1.	Friction plate worn.	Replace.	IV-03
		2.	Separator plate worn.	Replace.	IV-03
		3.	Spring damage.	Check and replace.	IV-O2
e.	Parking brake	1.	Charge pump pressure is low.	Check the pressure.	
	can't be released. Brake seems to be staggered and low travel speed.	2.	Oil leaks of hose between charge pump and brake.	Check and replace.	
		3.	Friction plate worn.	Disassemble and check if it's burnt.	IV-03

## C. Testing and adjustment

#### a. Pedal stroke

ĺ	Α	1.97 ± 0.39 in. (50 ± 10 mm)
	В	

- A: Reference value
- B: Service limit

#### b. Negative brake function

- Start the engine to idle.
- Brake releasing condition: Shift the P-D lever from P to D position, foot sinks further.
- Brake applying condition:
   Shift the P-D lever from D to P position, foot is pushed up.

### c. Braking distance

Braking distance	16.4 ft >
(Inching valve installed)	5 m >

- (1) Braking point
- (2) Stop point
- (3) Travel (Max. speed)
- (4) 65.6 ft (20 m) or more
- (5) Braking distance
- 1. Run the loader at the maximum speed.
- Apply the brake and measure the distance the loader has traveled until stopping. [Treadling force: 78.91bs (35.8 kgf) ] Standard: 16.4 ft (5 m) or less
  - \* Uneven braking is never allowed.

Braking distance	F.H: 13.1±1.6ft (4.0±0.5m)
(Dynamiic brake only by releasing accel pedal.)	F.L: 3.3±1.6ft (1.0±0.5m)

#### d. Parking brake capacity

Max-slope angle to keep the machine with lever P position. Engine stop condition

15° or more

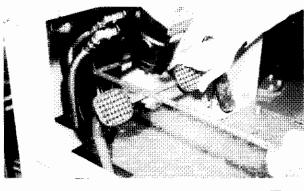
### e. Travel block performance on slope

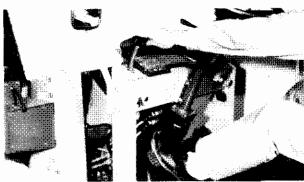
 $6.6 \pm 1.6$  ft (2.0  $\pm$  0.5 m) /30 sec.

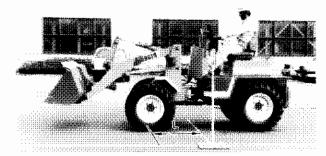
Condition: Slope: 15° Oil temp: 122±41°F (50±5°C) No load with STD counter weight

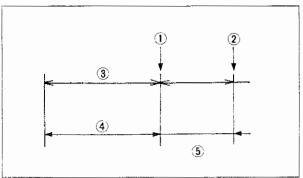
Lever: Neutral, Low range

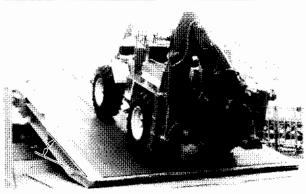
Engine: Idling rpm











## D. Servicing

### a. Brake pedal & linkage

- 1) Brake (Inching) pedai.
- (2) Return spring
- (3) Master cylinder
- (4) Inching rod.

Inching	Treading force	13.2 lbs (6 kg)
	Stroke	1.57 in. (40 mm)
Braking	Treading force	78.9 lbs (35.8 kg)
	Stroke	0.79 in. (20 mm)

## (when reassembling)

· Adjustment of inching pedal.

The vehicle should not move while pressing the inching pedal, full engine rpm and shifting F/R lever. (Pressure differential between PL1 and PL2 ports must be approx. zero.

- (A) Inching stroke
- (B) Braking stroke
- 1 Brake pedal
- (2) Control cable
- (3) Link arm
- 4 Inching spool
- (5) Spring pin
- Meet align mark when mounting linkage at the control valve side.
- Minute adjustment is required when start-up engine rpm is out of specification.

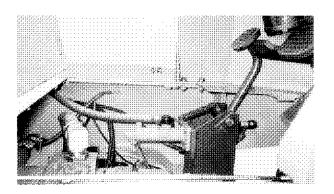
In that cas, loosen the lock nut and slightly turn the link rod

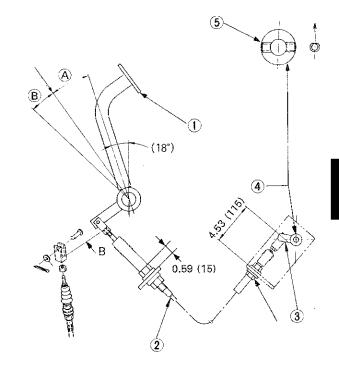
Check the start-up engine rpm:  $1100^{+50}_{-100}$ 

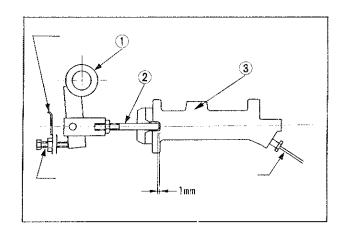
· Adjustment standard of brake.

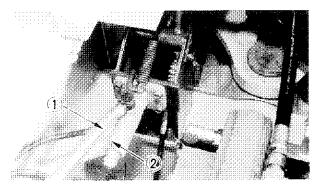
Adjust the rod position as shown in left fig..

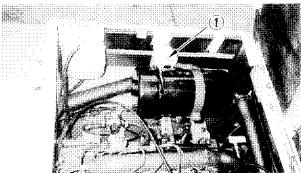
- A Play of push rod: 0.04 to 0.08 in (1 to 2 mm)
- B Pedal stopper bolt adjustment:
  - 1) Brake arm
  - 2 Push rod
  - (3) Master cylinder

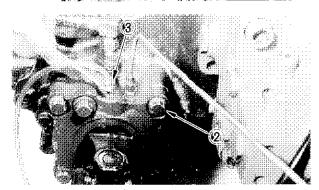


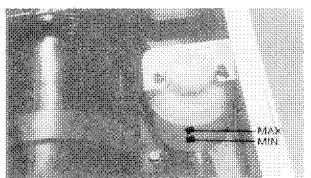












#### b. Master cylinder disassembling/reassembling.

- 1. Disconnect the hoses and pipes.
  - Catch oil with the oil pan.
- 2. Dismantle the master cylinder.
  - (1) Hose

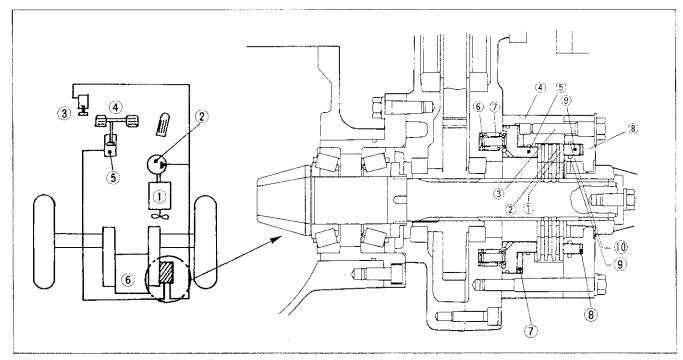
#### (when reassembling)

- Air bleeding procedure
- 1 Replenish hydraulic oil, ISO VG32 in the brake fluid cup (1) . 0.08 gal (0.3%)
  - Disconnect the hose frm the master cylinder.
- 2 Tighten hose after checking if fluid flows out from it.
- While pressing the brake pedal like pumping, loosen the air-bleeder to bleed.
- 4 Tighten the bleeder after bleeding.

#### (Notes)

- Refill fluid in when its volume decrease to less than 1/3.
- It is easy to check air condition when inserting a transparent vinyl tube into bleeder.
- 5 Repeat working 4 until air or bubble disappear.
- 6 Check brake working and no oil leakage.
  - 1 Brake fluid cup
  - 2 Brake oil inlet plug
  - (3) Air bleeder

### c. Brake assy reassembling



- Engine
- 2) Charge pump
- (3) P-D lever
- 4 Brake pedal
- Master cylinder
- 6 Diff-axle
- 7 From charge pump.
- (8) From master cylinder
- 9 Brake seal 1
- (10) Brake seal 2

- 1) Separator plate (4 pcs)
- 2 Friction plate (3 pcs)
- 3 Parking brake releasing pin (2 pcs)
- (4) Piston retainer
- (5) Piston (Parking brake)
- 6 Spring 1 (22 pcs) dia = \$\pi 2.3 mm

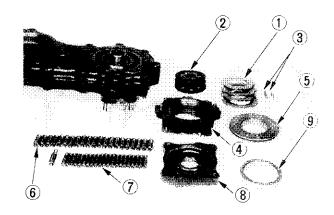
Free length = 40.0 mm

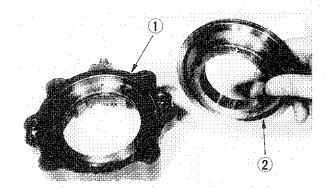
7 Spring 2 (22 pcs)

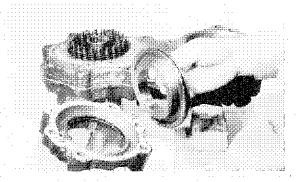
dia = Ø1.4 mm

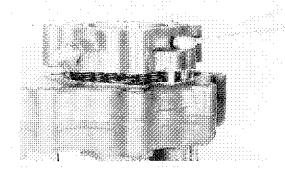
Free length = 49.0 mm

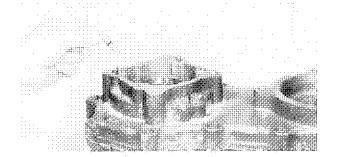
- (8) Brake cover
- (9) Piston (Service brake)











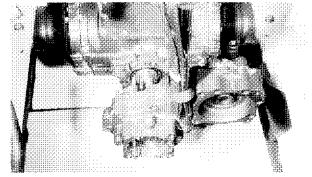
- 1. Install D-rings into piston retainer and parking piston.
  - Piston retainer
  - 2 Parking piston

- 2. Install parking piston into piston retainer.
  - \* Apply grease on D-ring. Never damage D-ring.

- 3. Install the piston retainer assy into reduction gear case.
  - Liquid gasket should be applied onto packin 1.
  - Springs, 22 sets of large and small, should be installed properly.

4. Insert two pins with O-ring for negative brake releasing.

5. Hanging up the reduction gear case assy, install it with differential assy.



First install the separator plate and friction plate.
 Install 4 pieces of separator plates and 3 pieces of friction plates alternately.



Separator plates: 4 pieces: 68881-1523-0

Reference thickness	in. (3.1 ± 0.1 mm)	
Service limit (Warp)	5.91 in. (0.15 mm) below	

1 or less

(2) 6 Equal Divisions

2 3. 1±0. 1 2 15 2 1 0. 5 1 0. 5 1

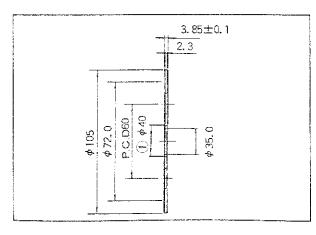
Friction plate: 3 pieces: 68881-1524-0

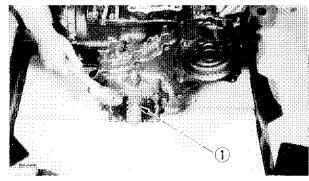
Reference thickness	in. (3.85 $\pm$ 0.1 mm)
Service limit	in. (3.45 mm)

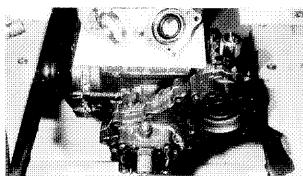
#### <When installing>

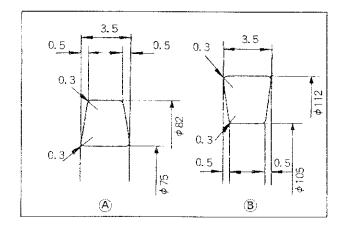
Apply engine oil 10W30

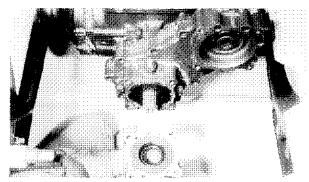
1 Large Diameter











7. Tap in snap wire.

- 8. (1) Install brake seal into brake cover.
  - 2 Install service piston into brake cover.

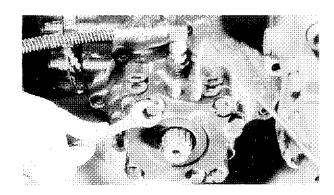
Note: Insert the piston evenly not to damage.

(When install the brake seal)

- Do not damage brake seal.
- Apply oil. Watch seal direction.
- A Brake seal 1
- (B) Brake seal 2
- 9. 1 Install packin with liquid gasket on both sides.
  - (2) Apply the grease on both brake cover and final seprator plate.

Put the final separator plate on the brake cover and install them jointly onto piston retainer.

· ··············	,
Tightening tyorque	in. (7.9 ~ 9.2 kgf.m)



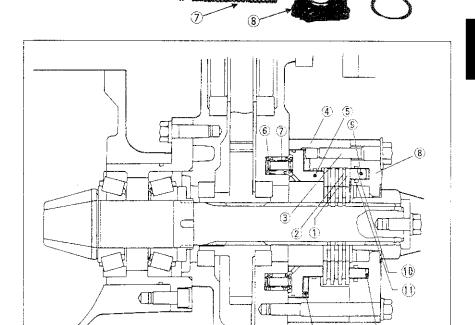
- (1) Separator plates 4 pcs
- (2) Friction plates 3 pcs
- (3) Negative brake releasing pin 2 pcs
- (4) Piston retain 1 pcs
- (5) Parking piston 1 pcs
- (6) Spring 1 22 pcs Wire dia.: ø2.3 mm

Free length: 40.0 mm

7 Spring 2 22 pcs Wire dia.: ø1.4 mm

Free length: 49.0 mm

- 8 Brake cover 1 pcs
- 9 Service piston 1 pcs
- 10 Brake seal 2
- (1) Brake seal 1
- (12) From master cylinder
- 13 From charge pump

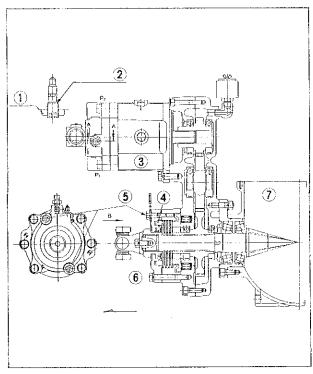


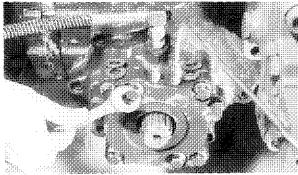
#### <Specific caution>

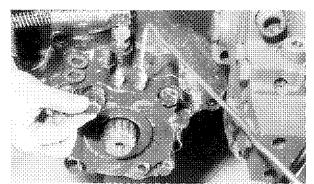
- 1. Be sewre that no dust is intruded.
- 2. Brake seal direction should be prper.
- Separator plates and brake cover position should be aligned.
- 4. When installing the separator plate (final one), apply grease and install properly.

(12)

 $(\vec{1}\vec{3})$ 







### d. Machine traction method when repairing.

1. Opening of LST looped circuit

Loosen lock nut 1 and return bypass valve 2 by 1.5 turn.

<Note>

Loosening more than two turn, oil may leak.

Tightening torque

Býpass valve:

7.2 ft.lb (1 kgf.m)

Lock nut:

21.7 ~ 28.9 ft.lb

(3.5 ~ 4.0 kgf,m)

- (1) Lock nut
- (2) Bypass valve
- (3) LST motor
- (4) Service brake piston
- (5) Bolt (M12 x 20), plain washer
- (6) Brake assy
- (7) Rear diff. axle

#### 2. Releasing of negative brake

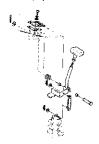
- (1) Remove bolt (2 pcs), take out plain washers (2 pcs in two places) and retighten bolts only.
- After loading the machine onto truck, install two plain washers and tighten the bolts, so that negative brake functions.

#### Caution!

Pull the machine very slowly and not too far. Otherwise, LST pump and motor may seize inside.

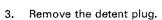
### e. D-P valve removal/disassembling

1. Pull out the snap pin and extract the pin.

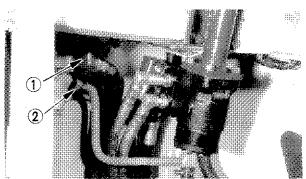


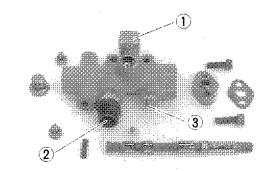
- 2. Disconnect hoses and piping.
  - (1) From charge pump
  - 2 Return to tank

When removing pipe ②, loosen thee pipe nut at steering controller side.



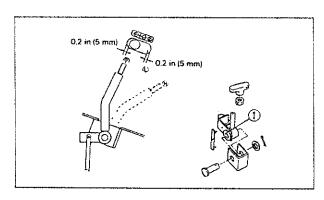
4. Take out the detent springs and balls. Pull out the spool.





### (When reassembling)

- Clean and blow the spool and valve body with air.
- Check if spool is smooth.
  - 1) Elbow: PT3/8 From charge pump
  - (2) Body: PT3/8 To return to tank
  - (3) Adaptor: PT1/4 To negative brake



### (When installing the lever)

Adjust the lever clearance to 0.2 in. (5 mm) or more.

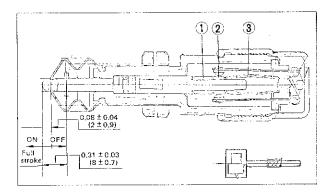
1) Shim thickness: 0.04 in. (1 mm)

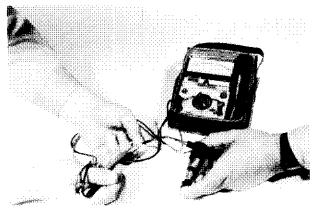
<Operating force>

 $5.3 \pm 1.1 \text{ lbs } (2.4 \pm 0.5 \text{ kgf})$ 

<Lever stroke>

 $1.70 \pm 0.4$  in.  $(43 \pm 10 \text{ mm})$ 





## f. Safety switch (Parking)

When the H-L-P lever is shifted to P position, switch shaft is pressed to contact the points. Thus parking lamp and HST filter lamp come on.

Code No.: 55611-41831

When the rod is pushed: Conductive When the rod is free: Not conductive

	AV 1.25G	AV 1.25G
Free		
Pushed	0	

- ① Contact
- 2 Insulator
- 3 Spring
- 4 Coupler

#### <Testing>

Push the shuft and check conductivity.

#### (Note)

Safety switch and stop lamp switch has same looking but conductivity is opposite.

Identify with the connector.

# Section V

# **Steering System**

## ---- CONTENTS ----

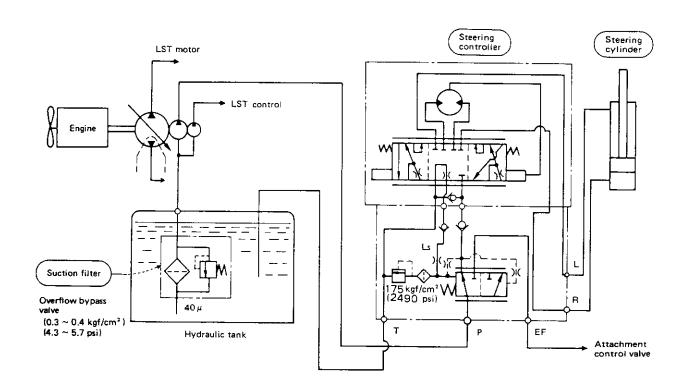
Α.	Sp	ecification	V-01
	a.	Steering wheel & column	
	b.	Steering controller	
	C.	Main pump	
	d.	Steering cylinder	
	e.	Hydraulic tank	
В.	Tro	publeshooting	V-05
C.	Tes	sting & Adjustment	V-07
	a.	Main relief pressure	
	b.	Overload relief pressure A	
	C.	Overload relief pressure B	
	d.	Main pump flow rate	
	e.	Steering cylinder internal leakage	
	f.	Steering wheel	
	g.	Hoses and fitting installation	
D.	Se	rvicing	V-11
	a.	Steering cylinder removing	V-11
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	C.	Steering post removing	V-15
	d.	Steering controller disassembling	V-16
	e.	Control valve disassembling	V-17
	f.	Flow priority valve disassembling	V-18

# A. Specification A. Caractéristiques

## Steering wheel & column

### Volant et colonne de direction

		R510	Remarks <i>Remarques</i>
Steering wheel diameter Diamètre du volant de direction  Operating force Force de fonctionnement		15.75 in (400 mm)	
		3.53 ± 1.1 lbf (1.6 ± 0.5 kgf)	Engine rpm Idle or max. Régime de ralenti du moteur ou max.
No. of turning (End to end)	Left Gauche	3.2 ± 0.5	End to end d-une extrémité a l'ceutre.
Nbtr fr goutd 'd-une extrémité al-aeetre)	Right Droite	4.8 ± 0.5	End to end d-une extrémité a l'ceutre.
Slippage Patinage			
Steering wheel circumferential play leu de circonférence du volant de direction	Reference Reference	≦ 1.97 in. (50.0mm)	
	Service limit Limite de service		
Steering wheel vertical play	Reference Reference	≤ 0.02 in. (0.5 mm)	
leu vertical du rolant de direction	Service limit Limite de service		
Steering wheel nut tighte Couple de serrage de récro		57.1 ~ 66.5 ft.lbf (7.9 ~ 9.2 kgf.m)	



# b. Steering controllerb. Contrôleur de direction

- < Orbitrol >
- < Orbitrol >

-	R510	
Maker	Sumitomo Eaton	
Fabricant	Sumitomo Eaton	
Type Type	LC-D1-A LG-D4-A	
Max. permissible pressure Pression admissible max.	2490 psi (175 kgf/cm²)	
Max. permissible back pressure Contre-pression admissible max.	14.2 psi (10 kgf/cm²)	
Max. allowable temperature Température admissible max.	203°F (95°C)	
Input torque to rotate Couple d'entrée pour tourner	1.45 ft.lbf (0.2 kgf.m)	
Gerotor displacement Cylindrée de Gerotor	11.90 cu.in (195 cm <sup>3</sup> /rev)	
Gerotor thickness Epaisseur de Gerotor	1.00 in. (25.4 mm)	

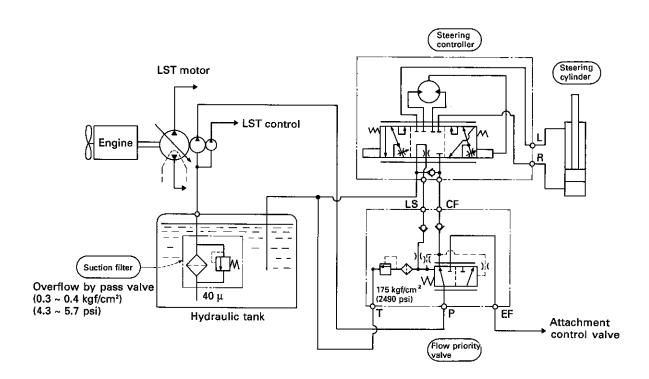
# <VP control valve> <Soupape de commande VP>

		R510	
Type Type Control spring force Force du ressort de commande		Load sensing flow priority type with main relief valve Type à priorité de débit détection de charge avec clapet de décompression principal et de surcharge  25.6 psi (1.8 kgf/cm²)	
Actual port pressure Pression d'orifice réel	2630 ± 70 psi (185 ± 5 kgf/cm²)		

# A. Specification A. Caractéristiques

- Steering wheel & column Volant et colonne de direction

		R510	Remarks <i>Remarques</i>
Steering wheel diameter Diamètre du volant de direction		15.75 in (400 mm)	
Operating force Force de fonctionnement		3.53 ± 1.1 lbf (1.6 ± 0.5 kgf)	Engine rpm Idle or max. Régime de ralenti du moteur ou max.
No. of turning (End to end)	Left Gauche	3.2 ± 0.5	End to end d-une extrémité a l'ceutre.
Nbtr fr goutd (d-une extrémité al-aeetre)	Right Droite	4.8 ± 0.5	End to end d-une extrémité a l'ceutre.
Slippage Patinage			
Steering wheel circumferential play	Reference Reference	≦ 1.97 in. (50.0 mm)	
leu de circonférence du volant de direction	Service limit Limite de service		
Steering wheel vertical play Jeu vertical du volant de direction	Reference Reference	≤ 0.02 in. (0.5 mm)	
	Service limit Limite de service		
Steering wheel nut tighte Couple deserrage de récre	• •	57.1 ~ 66.5 ft.lbf (7.9 ~ 9.2 kgf.m)	



# b. Steering controllerb. Contrôleur de direction

< Orbitrol >

< Orbitrol >

	S/N10001 ~ S/N20013	S/N20014 ~
Maker Fabricant		no Eaton no Eaton
Type Type	LC-D1-A LG-D4-A	LG-D2-A
Max. permissible pressure Pression admissible max.	2490 psi (1	75 kgf/cm²)
Max. permissible back pressure Contre-pression admissible max.	14.2 psi (10 kgf/cm²)	
Max. allowable temperature Température admissible max.	203°F (95°C)	
Input torque to rotate Couple d'entrée pour tourner	1.45 ft.lbf (0.2 kgf.m)	2.17 ft.lbf (0.3 kgf.m)
Gerotor displacement Cylindrée de Gerotor	11.90 cu.in (195 cm <sup>3</sup> /rev)	11.29 cu.in (184 cm³/rev)
Gerotor thickness Epaisseur de Gerotor	1.00 in. (25.4 mm)	0.94 in. (24.0 mm)

### <Flow priority valve>

		R	510
Type Type		Load sensing type with ma Type à priorité de débit détection décompression principal et de	in relief valve on de charge avec clapet de surcharge
Control spring force Force du ressort de commai	nde	25.6 psi (1.	8 kgf/cm²)
Main relief pressure Pression de décompression principale	Bench set pressure Pression réglée au banc	2490 + 40 psi - 30	(175 <sup>+3</sup> kgf/cm²)
	Actual port pressure Pression d'orifice réel	2630 ± 70 psi (185 ± 5 kgf/cm²)	$\triangle$ 2560 ± 70 psi (180 ± 5 kgf/cm <sup>2</sup> )

# c. Main pump c. Pompe principale

	•	R510
Type Type		Gear, tandem type Engrenage, type tandem
Maker Fabricant		KAYABA
Theoretical discharge capacity (Engine RPM = 2600) Capacité de décharge théorique (Régime du moteur = 2600 tr/mn)		1.40 in <sup>3</sup> /rev (22.9 cc/rev)
		15.73 gal/min (59.54 ½/min.)
Factory spec.	No load	1.38 ±0.03 in <sup>3</sup> /rev
Caractéristiques	A vide	(22.65±0.5 cc/rev)
techniques usine	355 psi	15.6±0.3 gal/min
	(25 kgf/cm <sup>2</sup> )	(58.9±1.3   /min)
	Load	1.32±0.03 in <sup>3</sup> /rev
	En charge	(21.65±0.5 cc/rev)
	2775 psi	14.9±0.3 gal/min
	(195 kgf/cm <sup>2</sup> )	(56.3±1.3 ℓ /min)
Service limit (80%) Limite de service (80 %)		1.11 in <sup>3</sup> /rev (18.12 cc/rev)
		12.45 gal/min (47.1 ½/min)
Max. durable pressure Pression durable max.		2490 psi (175 kgf/cm²)
Rated load pressure (Actual)		2630 ± 70 psi (185 ± 5 kgf/cm <sup>2</sup> )
Pression de charge nom	·	(100 ± 5 kg)/cm²)
Part No. (Main pump ass No. de pièce (ensemble d		
Seal kit No. No. de Kit de joint		
Unit weight		

# d. Steering cylinderd. Cylindre de direction

- < Part specification >
- < Caractéristique de pièce >

		R510
Туре		Double-acting type
Type		Type à action double
Maker Fabricant		Komatsu Zenowa
Tube I.D. × rod O.D.  D.I. de tube × D.E. de tige		2.76 x 1.38 in (70 x 35 mm)
Retraction length/stroke	_	20.63 ± 0.08 in. (524 ± 2 mm)/
Longueur de rétraction ma	x./course	$10.0 \pm 0.05$ in (254 $\pm$ 1.25 mm)
Bush internal dia. x width (Rod side)	Reference value Valeur de référence	$1.38^{+0.096}_{-0.02} (35^{+0.25}_{-0.05}) \times 1.77^{+0}_{-0.02} (45^{+0}_{-0.5})$
Diamètre interne de manchon (Côté tige)	Service limit Limite de service	1.42 (36)
Bush internal dia. x width (Bottom side)	Reference value Valeeur de référence	1.38 +0.098 (35 +0.25 ) × 1.77 +0.02 (45 +0.05)
Diamètre interne du manchon (Côté bas)	Service limit Limite de service	1.42 (36)
Part No. No. de pièce		68881-3481-3
Serial kit no. No. de kit de série		68881-93911
Weight Poids		23.37 lbs (10.6 kg)
Internal leakage Fuite interne		

# e. Hydraulic tank e. *Réservoir hydraulique*

	R510
Tank capacity Capacité de réservoir	12.95 gal. (49 ½)
Suction strainer Crépine d'aspiration	40 μ mm

# c. Main pump c. Pompe principale

		R5	10	
Туре		Gear, tandem type		
Туре		Engrenage, type tandem		
Maker Fabricant		КАҮАВА		
Theoretical discharge capacity (Engine RPM = 2600)		1.40 in <sup>3</sup> /rev (22.9 cc/rev)		
Capacité de décharge théorique (Régime du moteur = 2600 tr/mn)		15.73 gal/min (59.54 ½/min.)		
Factory spec.	No load	1.38 ±0.03 in <sup>3</sup> /rev		
Caractéristiques techniques usine	A vide	(22.65±0.5 cc/rev)		
tecriniques usine	355 psi	15.6±0.3 gal/min		
	(25 kgf/cm <sup>2</sup> )	(58.9±1.3   /min)		
	Load	1.32±0.03 in <sup>3</sup> /rev		
	En charge	(21.65±0.	5 cc/rev)	
	2775 psi	14.9±0.3 gal/min		
	(195 kgf/cm <sup>2</sup> )	(56.3±1.3 ℓ /min)		
Service limit (80%) Limite de service (80 %)			1.11 in <sup>3</sup> /rev (18.12 cc/rev)	
		12.45 gal/mir	n (47.1 ½/min)	
Max. durable pressure Pression durable max.		2490 psi (175 kgf/cm²)		
Rated load pressure (Actual) Pression de charge nominale (Réelle)		2630 ± 70 psi (185 ± 5 kgf/cm²)	$\triangle$ 2560 ± 70 psi (180 ± 5 kgf/cm <sup>2</sup> )	
Part No. (Main pump assy) No. de pièce (ensemble de pompe principale)				
Seal kit No. <i>No. de Kit de joint</i>				
Unit weight Poids de l'unité				

# d. Steering cylinderd. Cylindre de direction

- < Part specification >
- < Caractéristique de pièce >

Type of differential	installed	Standard Differential	Limited Slip Differential (LSD)
Туре		Double-acting type	
Туре		Type à action double	
Maker Fabricant		Zeno	pwa
Tube I.D. × rod O.D.  D.I. de tube × D.E. de tige		2.76 x 1.38 in (70 x 35 mm)	3.15 x 1.57 in (80 x 40 mm)
Retraction length/stroke		20.63 ± 0.08 in. (524 ± 2 mm)/	
Longueur de rétraction max./course		10.0 ± 0.05 in (254 ± 1.25 mm)	
Bush internal dia. x width (Rod side)	Reference value Valeur de référence	1.38 +0.098 (35 +0.2)	s <sub>5</sub> ) × 1.77 <sup>.0</sup> <sub>-0.02</sub> (45 <sup>.0</sup> <sub>-0.5</sub> )
Diamètre interne de manchon (Côté tige)	Service limit Limite de service	1.43	2 (36)
Bush internal dia. x width (Bottom side)	Reference value Valeeur de référence	1.38 +0.098 (35 +0.0	(45 ± 0.5) × 1.77 ± 0.02 (45 ± 0.5)
Diamètre interne du manchon (Côté bas)	Service limit Limite de service	1.42	(36)
Part No. <i>No. de pièce</i>		68881-3481-3	68891-34811
Serial kit no. <i>No. de kit de série</i>		68881-93911	
Weight Poids		23.37 lbs (10.6 kg)	23.37 lbs (10.6 kg)
Internal leakage Fuite interne			

## e. Hydraulic tank

## e. Réservoir hydraulique

	R510	
Tank capacity Capacité de réservoir	12.95 gal. (49 ℓ)	
Suction strainer Crépine d'aspiration	40 μ mm	

# **B.** Troubleshooting

Symptom	Suspected cause	Checking method	Remedy	Ref. page
a. Steering wheel is	Underinflation of tire.	Measure by the gauge.	Adjust inflation.	
hard to turn. (Main relief pressure is OK.)	Pin and bushing are rusted and sound sticky noise.	Remove.	Clear and apply grease.	V-11
,	Eccentric installation of column shaft and orbitrol spline.	Loosen the mounting bolt and check operating force.	Align the column shaft installation.	V-15
	4. Improper oil viscosity.	Check oil quality.	Replace with specified oil.	I- 17
	Ball bearing rusted or damage.	Pull the steering wheel up and down.	Replace the bearing.	V-15
b. Steering wheel is	Insufficient oil level.	Oil level check.	Add oil.	J-10
hard to turn. (Main relief pressure is low.)	Aeration in steering system.	Sample oil from the tank and visual check of oil color. White color indicates air intrusion.	Add oil to the specified level.  Slowly repeat the steering cylinder full stroke.	V-01
	Hydraulic hose damgaged and oil leaks.	Visual check.	Replace.	
	Hose joint is too tightened and spool sticks with housing.	Loosen the hose joint and check.	Tighten the hose joint to the speicfied torque.	V- 21
	Steering controller mounting bolts are too tightened.	Loosen the mounting bolts.	Tighten the mounting bolts to the specified torque.	V-16
	Flow priority spool sticks with metal particle.	Remove.	Clean and repair.	V-17
	7. Dust in the flow priority orifices.	Remove.	Clean and repair.	V-17
	Flow priority control spring damaged.	Remove.	Replace with new one.	V-17
	Main relief valve set pressure is low.	Check the pressure.	Readjust.	V-07
	Dust or metal particle intrudes in the main relief valve seat and ball.	Remove.	Clean and reassemble.	V-07
	Main pump discharge rate is low.	Check flow test and inspect wear.	Replace.	V- 08
	Orbitrol sleeve and spool are sticking.	Remove.	Replace.	V-17
	13. Steering cylinder piston rod breakage.	Check oil flow out of return line from the cylinder. Oil flow indicates the breakage.	Replace the cylinder.	V-11
c. Steering wheel is hard to turn.	Flow priority spool is sticking and restricting the oil flow.	Remove.	Clean or replace.	V-17
(Steering wheel turning speed is low.)	Steering controller check valve is open and oil bypass.	Remove.	Clean or replace.	V-17
	Pump discharge rate is low.	Check flow test.	Replace.	V-08

Symptom	Suspected cause	Checking method	Remedy	Ref. page
d. Improper response to steering wheel.	Looseness of steering cylinder pin and bushing.	Remove and measure.	Replace.	V-11
	Looseness of steering column.	Remove and check bearing and bushing.	Replace.	V-15
	Aeration in the steering controller or generator.	Sample oil and check.	Add oil to the specified level or replace with proper oil.	I- 01
	<ol> <li>Uneveness of inflation pressure of right and left tires.</li> </ol>	Check with tire gauge.	Adjust.	
	5. Steering cylinder aeration	Loosen the hoses of cylinders and visual check.	Bleed air.	V- 01
	Steering cylinder piston seal damage. Internal oil leakage.	Cylinder seal tight check.	Replace.	V-12
	Oil leaks through check valve.	Remove	Clean and check.	V-16
	Main pump discharge rate is low.	Flow rate check.	Replace.	V-08
e. Steering wheel doesn't return to its	Eccentric installation of column shaft and orbitrol spline.	Loosen the mounting bolts.	Reinstall with shim adjusting.	V- 15
neutral.	Column shaft and orbitrol spline rusted.	Remove.	Clean.	V-15
	Orbitrol spool and sleeve are stick.	Remove.	Check and replace.	V-17
<li>f. Steering wheel slippage is large.</li>	Dust intrudes in the valve seat.	Remove.	Clean or replace.	V-17
	Dust in the anti-cavitation valve.	Remove.	Clean or replace.	V- 17
	Adjusting screw O-ring damage.	Remove.	Replace.	V- 17
g. Abnormal noise.	Suction strainer clogging.	Visual check of cylinder hose.	Clean the suction strainer,	I- 17
	Cavitation due to low oil level.	Check oil level.	Add oil.	
	Improper oil usage.	Check oil quality.	Replace with specifried oil.	
	Steering column bearing damage.	Remove.	Replace.	V-15
	Steering cylinder pin and bushing have rust or excessive wear.	Remove.	Clean or replace.	V-11
	6. Dust in the main relief valve.	Remove.	Clean.	V-17
	7. Column shaft spline rusted.	Remove.	Clean.	V- 15
	Eccentric installation of column shaft and orbitrol spline.	Loosen the mounting bolts.	Reinstall with shim adjusting.	V-15

## C. Testing & Adjustment

#### Main relief pressure

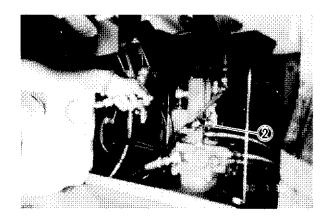
#### <Procedure>

Install the pressure gauge at test port as shown in photo. Relieve the steering circuit at the stroke end of steering cylinder.

- 1 Pressure gauge port
- 2 Main pump
- 3 Charge pump



• Oil temp.: 113 ± 41°F (45 ± 5°C) • Engine: Rated rpm: 2600 rpm



# <Specification>

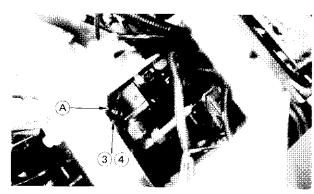
psi (kgf/cm²)

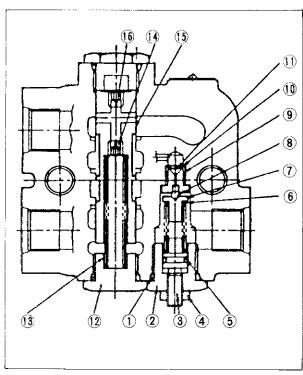
	R510
Actual port pressure	2630 ± 70 (185 ± 5)
Bench set pressure	2490 <sup>+40</sup> (175 <sup>-2</sup> / <sub>-2</sub> )

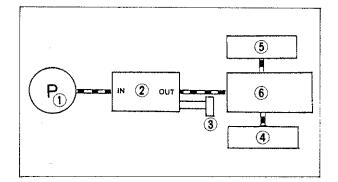
#### <Adjustment>

- Loosen the lock nut 4.
- 2. Tighten or return the adjusting screw 3 while relieving.
  - A Location of main relief valve
  - (1) O-ring
- 2 Relief plug 3 Adjusting screw
- 4 Lock nut
- ⑤ O-ring
- 6 Relief spring
- 7 Ball guide
- 8 Ball

- 9 Seat
- 10 Screen
- (1) Ring
- 12 Spool plug
- (3) Control spring
- 1 Dy orifice
- (15) Priority spool
- 16 PP orifice







#### b. Main pump flow rate

#### <Procedure>

- Install the pressure gauge and flow meter as shown in the
  - Main port outlet
- (5) Front sjavel loader
- 2 Flow meter
- (6) Flow prioroty valve
- (3) Loading handle
- 4 To steering controller P port
- First check the main relief pressure.
- Test the flow rate without any load at engine rated RPM.
- Apply the load pressure and read the flow rate and engine RPM.
- 5. Calculation of volumetric efficiency

Tested engine RPM with load x Rated engine RPM (2600) Tested flow rate with load = Flow rate Volumetric Tested flow rate x 100 (%) Theoretical flow rate efficiency

#### <Condition>

• Oil temp.: 113 ± 41°F (45 ± 5°C) • Engine: Max. rated (2600 rpm) When no load.

#### <Specification>

#### gal/min (l/min)

			R510
Flow	Theoretic	al	15.73
rate			(59.54)
	Factory spec.	No load 355 psi (25 kgf/cm²)	15.6 ± 0.3 (58.9 ± 1.3)
		Load 2775 psi (195 kgf/cm <sup>2</sup> )	14.9 ± 0.3 (56.3 ± 1.3)
	Service lin (80%)	nit Load	12.58 (47.6)
Loading	pressure		2775 ± 70 195 ± 5

## C. Testing & Adjustment

#### Main relief pressure

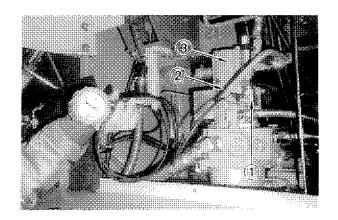
#### <Procedure>

Install the pressure gauge at test port as shown in photo. Relieve the steering circuit at the stroke end of steering cylinder.

- 1 Pressure gauge port
- (2) Main pump
- 3 Charge pump



• Oil temp.: 113 ± 41°F (45 ± 5°C) • Engine: Rated rpm: 2600 rpm



#### <Specification>

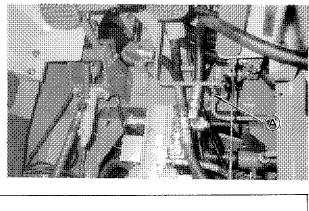
psi (kgf/cm²)

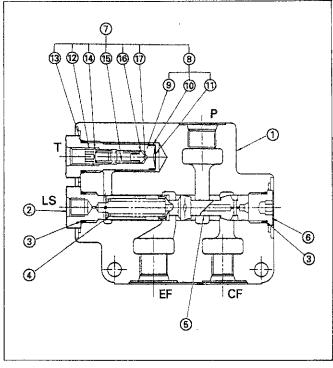
	R510
Actual port pressure	2560 ± 70 (180 ± 5)
Bench set pressure	2490 <sup>140</sup> (175 <sup>1</sup> / <sub>2</sub> )

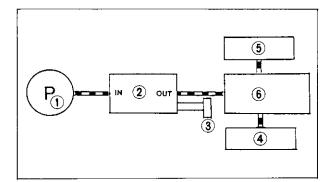
#### <Adjustment>

- 1. Loosen the pipe nut.
- 2. Tighten or return the adjusting screw  ${\mathfrak Q}$  while relieving.
  - A Location of main relief valve
  - 1 Housing
- ® Ring
- 2 Plug (LS port)
- ① Screen
- 3 O-ring
- ② Adjusting screw

- Control spring
- ③ O-ring
- ⑤ Priority spool
- (4) Spring guide
- 6 Spool plug
- 7 Relief valve cartridge
- (5) Relief spring
- 8 Body sub-assy
- 16 Ball guide
- 9 Body
- 17 Ball







#### **△ S/N 20014 ~**

#### b. Main pump flow rate

#### <Procedure>

- Install the pressure gauge and flow meter as shown in the photos.
  - 1 Main port outlet
- 5 Front sjavel loader
- 2 Flow meter
- (6) Flow prioroty valve
- Z Flow Illeter
- 3 Loading handle
- To steering controller P port
- 2. First check the main relief pressure.
- 3. Test the flow rate without any load at engine rated RPM.
- Apply the load pressure and read the flow rate and engine RPM.
- 5. Calculation of volumetric efficiency

Tested flow rate with load
Tested engine RPM with load x Rated engine RPM (2600)
= Flow rate

Volumetric
efficiency = Tested flow rate
Theoretical flow rate x 100 (%)

#### <Condition>

Oil temp.: 113 ± 41°F (45 ± 5°C)
 Engine: Max. rated (2600 rpm)
 When no load.

#### <Specification>

gal/min (g/min)

			R510
Flow	Theoretic	al	15.73
rate			(59.54)
	Factory spec.	No load 355 psi (25 kgf/cm <sup>2</sup> )	15.6 ± 0.3 (58.9 ± 1.3)
		Load <u>∱</u> \2915 psi (205 kgf/cm²)	14.9 ± 0.3 (56.3 ± 1.3)
	Service lin	mit Load	12.58
	(80%)		(47.6)
Loading	pressure		2915 ± 70 205 ± 5

#### c. Steering wheel

#### <Circumferential play>

- 1. Mark the wheel.
- 2. Align the scale with the mark on the wheel. Then turn the wheel to measure the play.
  - Standard play  $\leq 1.97$  in (50 mm) (in circumferential direction)

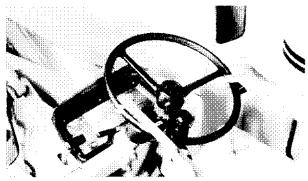
#### <Vertical play>

- 1. Remove the wheel cap.
- 2. Set the dial gauge in place.
- 3. Move the wheel vertically to measure the play.
  - Standard play  $\leq 0.02$  in (0.5 mm)

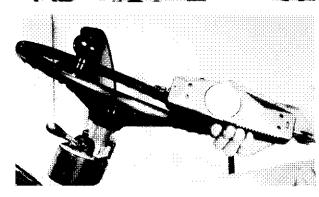


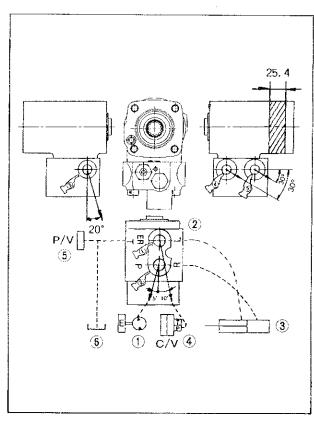
- 1. Set a push-pull scale in the knob position.
- 2. Idle the engine at 850 to 1000 rpm.
- 3. Draw the scale in a trangential direction.
  - Standard value: 3.53 ± 1.1 lbf (1.6 ± 0.5 kgf)

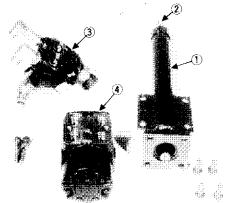
#### <Slippage>











#### d. Hoses and fitting installation

#### Tightening torque:

(PF1/2) 86.8 ~ 101.3 ft-lb (12.0 ~ 14.0 kgf.m)

(PF1/2) 43.4 ~ 47.0 ft-lb (6.0 ~ 6.5 kgf.m)

(PF3/8) 57.9 ~ 72.3 ft-lb (8.0 ~ 10.0 kgf.m)

(PF3/8) 36.2 ~ 39.8 ft-lb (5.0 ~ 5.5 kgf.m)

(PF3/8) 36.2 ~ 39.8 ft-lb (5.0 ~ 5.5 kgf.m)

PT and PF should be followed to the STD tightening torque table.



Rotor spacer thickness: 1.00 in. (25.4 mm)

- 1 Main pump
- (2) Steering controller
- 3 Steering cylinder
- (4) Front loader control valve
- (5) D-P control valve
- 6 Tank

#### Air bleeding

After disassembling and reassembling, bleed the air out of the steering system by slowly turning the steering wheel. And check steering cylinder and front frame are normally moving.

Engine: Medium rpm.

- 1) Steering column
- (2) Shaft
- (3) Valve unit
- (4) Steering controller

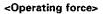
#### c. Steering wheel

#### <Circumferential play>

- 1. Mark the wheel.
- 2. Align the scale with the mark on the wheel. Then turn the wheel to measure the play.
  - Standard play ≤ 1.97 in (50 mm) (in circumferential direction)

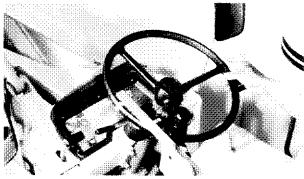
#### <Vertical play>

- 1. Remove the wheel cap.
- 2. Set the dial gauge in place.
- 3. Move the wheel vertically to measure the play.
  - Standard play ≤ 0.02 in (0.5 mm)

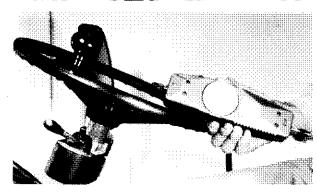


- 1. Set a push-pull scale in the knob position.
- 2. Idle the engine at 850 to 1000 rpm.
- 3. Draw the scale in a trangential direction.
  - Standard value: 3.53 ± 1.1 lbf (1.6 ± 0.5 kgf)

#### <Slippage>

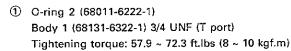






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# d. Hoses and fitting installation



② Elbow (68891-6486-1) (L port)

③ O-ring 2 (68011-6222-1) Elbow (68891-6461-1) 3/4 UNF Tightening torque: 32.5 ~ 39.8 ft.lbs (4.5 ~ 5.5 kgf.m)

O-ring (68891-6464-1)
 Elbow (68891-6463-1) 7/16 UNF (LS port)
 Tightening torque: 14.5 ft.lbs (2 kgf.m)

⑤ Elbow (68021-6244-1) (R port)

© O-ring 2 (68011-6222-1)
 Elbow (68891-6462-1) (P port)
 Tightening torque: 32.5 ~ 39.8 ft.lbs (4.5 ~ 5.5 kgf.m)

Steering controller

8 Steering cylinder

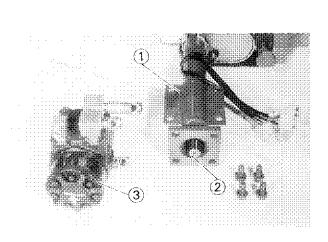
9 P port

(8)

1 T port

① L port (Rod side)

® R port (Bottom side)



#### Air bleeding

After disassembling and reassembling, bleed the air out of the steering system by slowly turning the steering wheel. And check steering cylinder and front frame are normally moving.

Engine: Medium rpm.

(1) Steering column

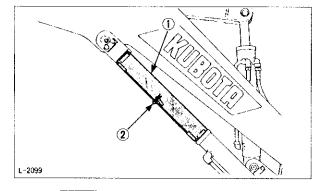
(2) Shaft

3 Steering controller

## D. Servicing

#### a. Steering cylinder removing

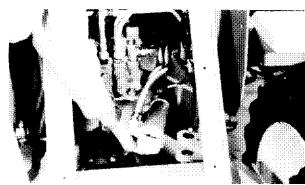
- Raise up the front shovel and install the lift arm support device for safety.
- 2. Remove the front cover.



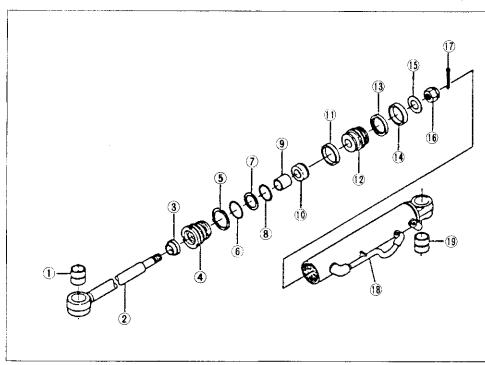
3. Hammer out the pins at the steering cylinder both ends.

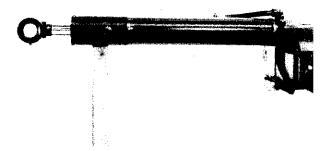


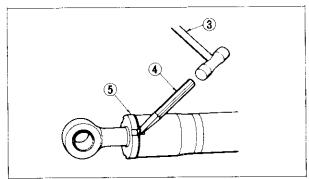
4. Remove the steering cylinder.

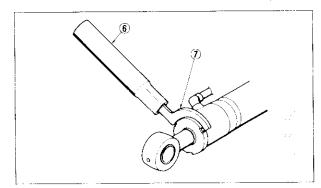


- Part designation
- ① Pin bushing
- 2 Piston rod
- 3 Wiper ring
- 4 Cylinder head
- (5) Lock washer
- 6 O-ring
- Back-up ring
- 8 O-ring
- 9 Bushing
- (0) U-ring
- U Slide ring
- 2 Piston
- 13 Seal ring
- 3 Slide ring
- 15 Shim
- (6) Castle nut
- ① Split pin
- (8) Cylinder tube
- Pin bushing









## b. Cylinder disassembling/reassembling

- 1. Drain the oil.
- 2. Hold the cylinder in a vise.



Place a wood block under the cylinder tube.

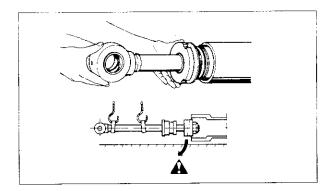
- 3. Undo the two lock tabs (5) of the lock washer at the cylinder head (one location each at the head and the tube).
  - 3 Hammer
  - 4 Chisel
  - (5) Lock tab
- 4. Loosen the cylinder head with a spanner.
  - (6) Pipe
  - 7 Hook wrench

#### (When reassembling)

Cylinder head tightening torque.

ft.lbs (kgf.m)

	Steering	Lift	Tilt
Cylinder head screw size	M75 x 2	M75 x 2	M85 x 2
Tightening torque	557 ± 5.6 (55 ± 5.5)	557 ± 5.6 (55 ± 5.5)	521 ± 5.2 (72 ± 7.2)



- 5. Pull out the cylinder head and the piston together.
  - \* Make sure the piping port is open.
  - \* Place an oil pan under the port at the retreat (cylinder head) side.

Do not allow the piston end to drop down just when pulling out the piston. Otherwise you may get your hand injured or the piston itself may get damaged.

Now release the cylinder tube from the vise.



Attention to a fall!

- 6. Fix the piston rod at the vise.
  - Be sure to place the wood block under the rod.
  - 8 Vise
  - Wood block

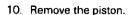
- 9
- 7. Remove the snap ring (wire) with a screwdriver.
- 8. Take the lock pin out of the piston.
- 9. Using a wrench, loosen the hex nut of the piston.
  - \* Preferably use a hydraulic jack and a specific wrench for easier work.
  - (10) Piston nut, R310: M16 × 1.5, R410: M20 × 1.5
  - ① Specific wrench
  - 12 Hydraulic jack

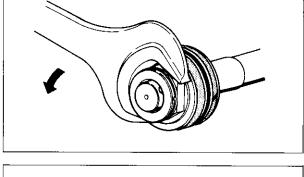
#### (When reassembling)

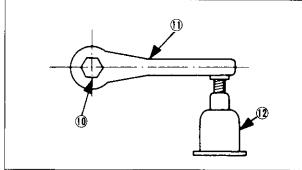
Spopper Nut tightening torque

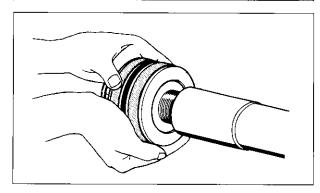
ft.lbs (kgf.m)

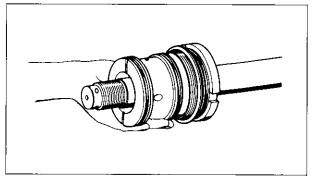
	Steering	Lift	Tift
Cylinder rod Nut screw size	M24 x 3	M27 x 3	M30 x 3
Tightening	$340 \pm 3.0$	456 ± 4.6	579 ± 5.8
torque	$(42 \pm 4.2)$	(63 ± 6.3)	$(80 \pm 8.0)$
Spanner size	36 mm	41 mm	46 mm







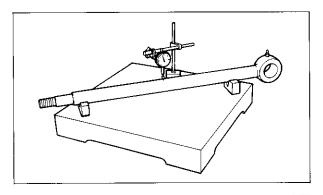


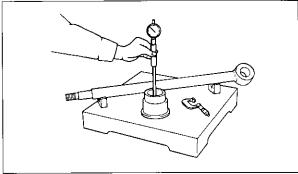


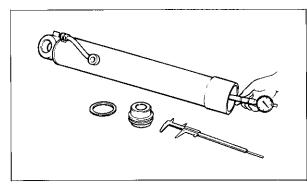
- 11. Pull out the cylinder head.
- 12. Release the piston rod from the vise.
  - Buffer ring

Install the square ring first and then the slide ring.

- \* Bend the slide ring into U shape with your fingers, and install into the groove.
- \* Do not bend the ring into a too small U, otherwise the ring may get wrinkles thereafter.
- Finally make sure there is no wrinkle or other permanent deformation left.







#### [Cylinder inspection]

- 1. Piston rod warp
- 1. Mount the piston rod on a V-block.
- 2. Set a dial indicator at the center of the rod.
- Rotate the piston rod and read the indicator. Warp is onehalf of the difference between the maximum and the minimum readings.
- If the value exceeds the allowable limit, replace the piston rod.
  - Reference value ..... warp within 0.002 in (0.05 mm)
  - Allowable limit ..... warp within 0.0197 in (0.5 mm)

#### 2. Clearance between piston rod and bushing

 Measure the piston rod O.D. and cylinder head bushing I.D. and determine the clearance.

	Rod size	Clearance
Reference	φ0.9843 to 1.5748 in	less than 0.010 in
value	φ1.7717 to 2.9528 in	less than 0.012 in
Allowable	φ0.9843 to 1.5748 in	0.0158 in
limit	φ1.7717 to 2.9528 in	0.0197 in

- Clearance between cylinder tube I.D. and piston ring O.D.
- 1. Measure the cylinder tube I.D.
- Calculate the piston ring thickness plus piston ring groove O.D. determine the clearance.

	Rod size	Clearance	
Reference	φ2.3622 in less	0.0020 to 0.0118 in	
value	φ2.5590 to 4.5276 in	0.0020 to 0.0138 in	
	φ4.7244 in more	0.0020 to 0.0157 in	
Allowable	φ2.3622 in less	0.0236 in	
limit	φ2.5590 in	0.0276 in	
	φ4.7244 in	0.0315 in	

#### c. Steering post removing

- Remove the wheel cap.
- 2. Remove the nut holding the steering wheel.

Wrench size: 17 mm (When reassembling)

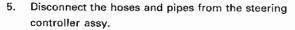
Tightening torque: 77.5 ~ 90.2 N.m.

7.9 ~ 9.2 kgf.m 57.1 ~ 66.5 ft.lbf

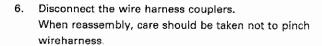
- 3. Use a puller to remove the wheel.
- 4. Draw the steering wheel out.

(When reassembling)

Align the key position.

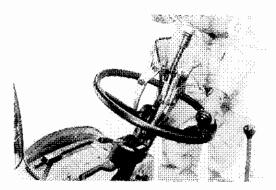


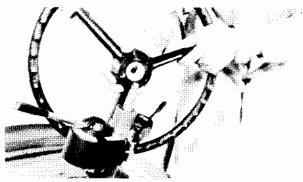
When retightening EF port pipe, loosen steering post mounting bolts (4 pcs) and return pipe.

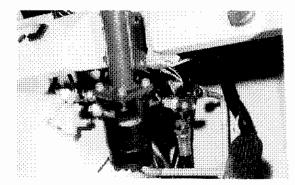


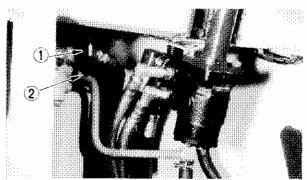
- 1 From charge pump
- (2) Return to tank
- 3 From main ;pump
- 4 EF port to front loader
- (5) To steering cylinder rod side (Turn left)
- 6 To steering cylinder bottom side (Turn right)
- Loosen the steering post, assy mounting bolts to remove it.
  - Bolt tightening torque: 35.4 ~ 41.2 ft.lb

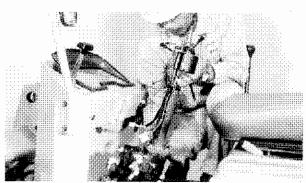
4.9 ~ 5.7 kgf.m

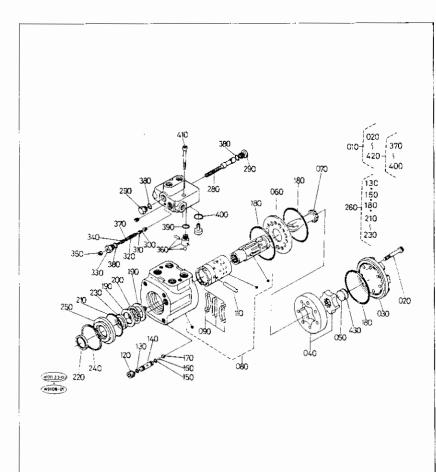












#### d. Steering controller disassembling

<Part designation>

CONTROLLER, STEERING 010

020 030 **SCREW** 

End cap

GEROTOR 040 050 SPACER

Spacer plate 060

070 DRIVE

ASSY PARTS, CONTROL CENTER SPRING 080

090

PIN 110

SCREW 120

O-Ring 130

SEAT, CHECK 140

150 O-Ring

BALL 160

BALL, CHECK 170

180

O-Ring RACE, BEARING 190

BERING, NEEDLE 200

210 RING

220 SEAL, DUST

230 240 SEAL, OIL Retaining ring BUSHING

250

260 KIT, SEAL

CONTROL SPRING 280

PLUG, SPOOL 290

300 BALL

BALL GUIDE 310

320

SPRING, RELIEF PLUG, RELIEF SCREW, ADJUSTING 330

340 350 LOCK NUT

Assy valve, check 360

370 O-Ring

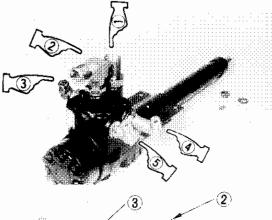
380 O-Ring

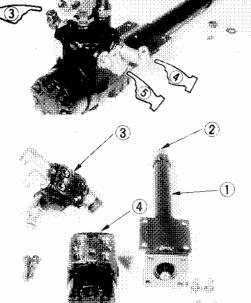
390 O-Ring O-Ring

400 Bolt

410 420 Bolt

430 Spacer





#### Steering post assy

- (1) P port (PF 1/2) 43.4 ~ 47.0 ft.lb (6.0 ~ 6.5 kgf.m)
- (2) Tank port (PF 3/8) 57.9 ~ 72.3 ft.lb (8.0 ~ 10.0
- (3) EF port (PF 1/2) 86.8 ~ 101.3 ft.lb (12.0 ~ 14.0 kgf.m)
- (4) L port (PF 3/8) 36.2 ~39.8 ft.lb (5.0 ~ 5.5 kgf.m)
- (5) R port (PF 3/8) 36.2 ~ 39.8 ft.lb (5.0 ~ 5.5 kgf.m)

#### Separation of the steering controller and control valve.

Tightening torque:

39.2 N.m

4.0 kgf.m

28.9 ft.lbf

Allen wrench:

8 mm

- 1) Steering post
- (2) Shaft
- (3) Valve unit
- (4) Steering controller

#### A S/N 20014 ~

#### c. Steering post removing

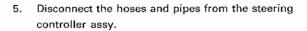
- 1. Remove the wheel cap.
- 2. Remove the nut holding the steering wheel.

Wrench size: 17 mm (When reassembling)

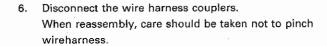
Tightening torque:  $77.5 \sim 90.2 \text{ N.m}$ 

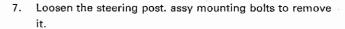
 $7.9 \sim 9.2 \text{ kgf.m}$   $57.1 \sim 66.5 \text{ ft.lbf}$ 

- 3. Use a puller to remove the wheel.
- Draw the steering wheel out.
   (When reassembling)
   Align the key position.



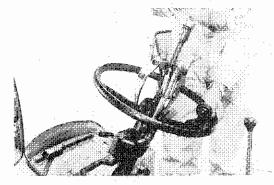
- ① P port (from CF port of priority valve)
- ② Return to tank
- 3 To steering cylinder rod side (Turn left)
- 4 To steering cylinder bottom side (Turn right)
- ⑤ LS port
- 6 From charge pump

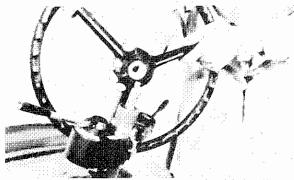


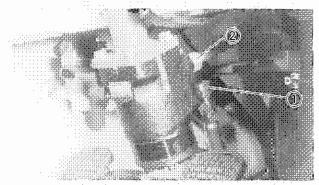


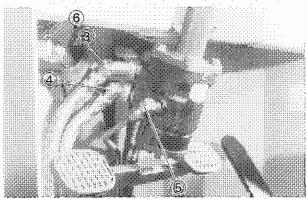
Bolt tightening torque: 35.4 ~ 41.2 ft.lb

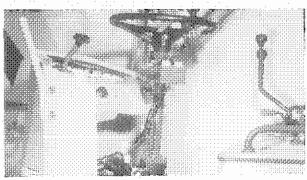
4.9 ~ 5.7 kgf.m





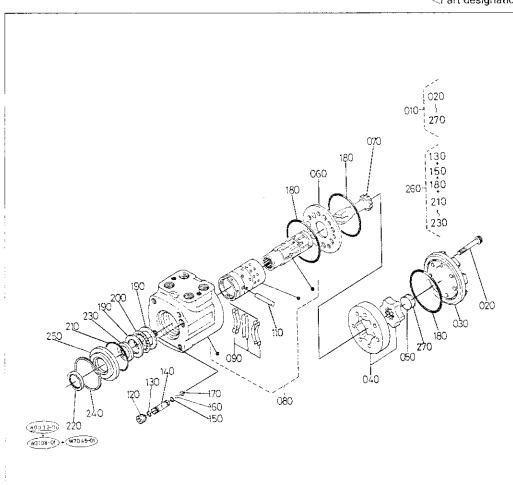




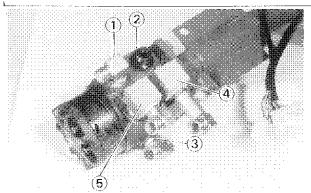


#### d. Steering controller disassembling

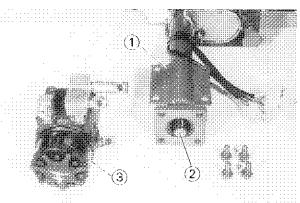
<Part designation>



010 CONTROLLER, STEERING SCREW 020 CAP,END 030 040 GEROTER 050 SPACER PLATE, SPACER 060 070 DRIVE ASSY PARTS, CONTROL 080 090 **SPRING** 100 BLANK 110 PIN 120 SCREW, SET 130 O-RING 140 SEAT, CHECK 150 O-RING 160 BALL BALL, RETAINER CHECK 170 180 O-RING 190 BEARING, LACE 200 NEEDLE, THRUST 210 RING SEAL, DUST 220 230 SEAL,OIL 240 RING, RETAINING 250 BUSH 260 KIT, SEAL **SPACER** 



- Steering post assy
  - ① P port (Elbow) 32.5 ~ 39.8 ft.lb (4.5 ~ 5.5 kgf.m)
  - ② Tank port (3/4 UNF) 57.9 ~ 72.3 ft.lb (8.0 ~ 10.0 kgf.m)
  - 3 LS port (7/16 UNF) 14.5 ft.lb (2.0 kgf.m)
  - 4 L port (3/4 UNF) 32.5 ~ 39.8 ft.lb (4.5 ~ 5.5 kgf.m)
  - ⑤ R port (3/4 UNF) 32.5 ~ 39.8 ft.lb (4.5 ~ 5.5 kgf.m)



Separation of the steering controller and control valve.

Tightening torque:

39.2 N.m

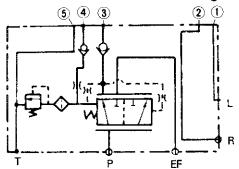
4.0 kgf.m 28.9 ft.lbf

Allen wrench:

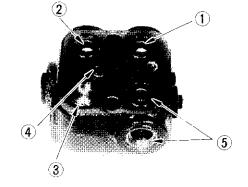
8 mm

- (1) Steering post
- (2) Shaft
- (3) Steering controller

#### e. Control valve disassembling



- (1) Left steering port
- (2) Right steering port
- 3 Pump port
- 4 Ls port
- ⑤ Tank port



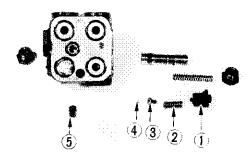
- 1. Unscrew the plugs 1 to remove the spring 3 and main spool 2.
  - Wrench size: 22 mm

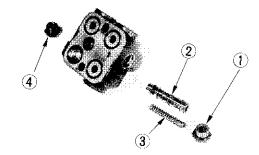
#### (When reassembling)

Be secure the direction of the main spool (2).



- 3. Take out spring (6), ball guide (7) and ball (8).
- 4. Unscrew the Ls orifice check valve (9).

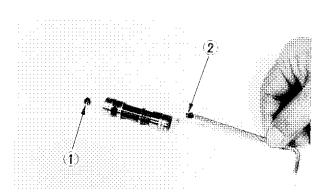


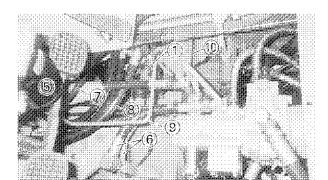


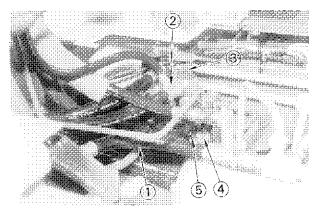
Unscrew to take the orifice out of the spool assy.
 Allen wrench: 3 mm

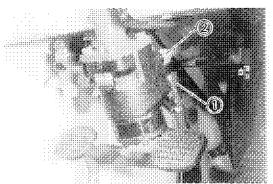
Never mix up two orifices of both sides.

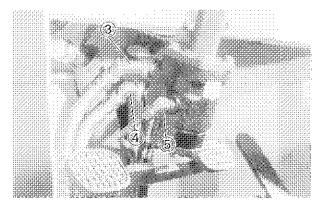
- 1) PP orifice
- ② DY orifice











#### **⚠** S/N 20014 ~

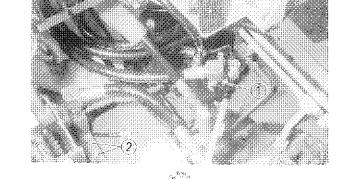
#### f. Flow priority valve disassembling

- 1. Location of flow priority valve
  - ① Flow priority valve assy (S/N 68891-3460-1)
  - ② LST pump
  - 3 Main (attachment) pump
  - 4 Charge pump
  - Steering controller
  - ⑥ Main pump → Flow priority valve
  - ⑦ Flow priority valve → Steering controller

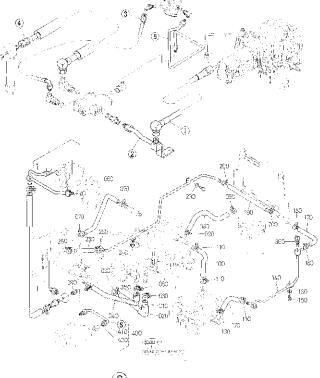
  - Steering controller → Flow priority valve
  - Flow priority valve → Tank
- 2. Ports of flow priority valve
  - ① P port
  - ② CF
  - 3 EF
  - 4 Ls
  - (5) T
- 3. Ports of steering controller
  - ① P
  - ② T
  - 3 L (to steering cylinder rod size)
  - R (to steering cylinder bottom side)
  - ⑤ Ls (to flow priority valve LS port)

#### A S/N 20014 ~

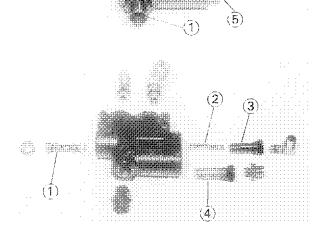
- Remove fittings of pipes and hoses.
   Remove mounting bolts.
  - 1 Mounting bolts of flow priority valve
  - ② Mounting bolts of pipe stay.



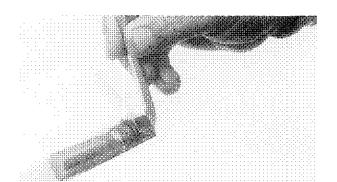
- 1 Main pump ~ Flow priority valve: 68891-6473-0
- 2 Main pump ~ Flow priority valve: 68891-6471-0
- 3 Flow priority valve ~ Steering controller: 68891-6467-0
- Flow priority valve ~ Loader control valve: 68891-6278-0
- Steering controller ~ Flow priority valve: 68891-6466-0
- 6 Flow priority valve ~ Tank: 68891-6483-0

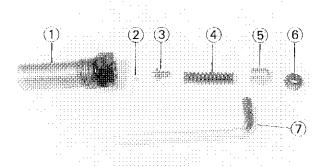


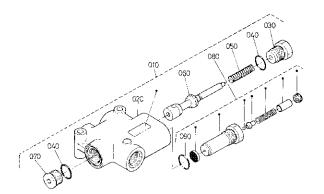
- 5. Size of fittings & tightening torque
  - ① Body 16 (UNF 7/8 ~ ) S/N 68221-6335-1
  - ② Elbow (UNF 3/4 ~ PF 3/8) S/N 68891-6462-1
  - ③ Elbow (UNF 3/4 ~ PF 3/4) S/N 68891-6468-1
  - 4 Elbow (
- ) S/N 68891-6463-1
- Straight nipple (
- ) S/N 68891-6469-1
- 6. Disassemble internal parts
  - 1 Priority spool
  - 2 Priority spring
  - 3 Plug
  - Relief valve cartridge



 $(\bar{3})$ 







## **△ S/N 20014 ~**

7. Disassemble relief valve cartridge

- 8. Internal parts of main relief cartridge
  - ① Cartridge
  - ② Ball
  - 3 Ball holder
  - 4 Spring
  - ⑤ Spring guide
  - 6 Adjusting screw
  - ① L-wrench, size: 7/32

  - 010 VALVE 020 HOUSING 030 PLUG 040 O-RING
  - O-RING SPRING SPOOL

  - 050 SPRING 060 SPOOL 070 PLUG 080 VALVE,CARTRIDGE 090 O-RING

# Section VI

# Front shovel loader

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C.	a.	Main relief pressure	VI-11 VI-12
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# A. Specifications Données techniques

# a. Gear pump (Main) Pompe à engrenages

Model / Modéle	R510 (B)		
Pump type	Tandem gear type		
Genre de pompe	Type à engrenages tandem		
Maker Fabricant	Kayaba		
Max. durable pressure Pression max.	2490 psi (175 kgf/cm²)		
Part No. Piece No.			
Assy seal part No.  Ensemble de joint pièce No.	<u>-</u>		

#### • Delivery rate Taux de refoulement

Model / Modéle	R510 (B)	
Theoretical discharge capacity  Capacité de décharge théorique	1.40 in <sup>3</sup> /rev (22.9 cc/rev)	
Engine: 2600 RPM	15.73 gal/min (59.54½/min)	
Service limit (80 %) Valeurs de limite de service	12.58 gal/min (47.6ℓ/min)	

#### Factory specifications

	Model / Modéle	R510 (B)	
No load <i>A vide</i>	355 psi (25 kgf/cm²)	15.6 ± 0.3 gal/min (58.9±1.3 ½ /min)	
Load <i>En charge</i>	2775 psi (195 kgf/cm²): 95%≤	14.9 ± 0.3 gal/min (56.3 ± 1.3 ½/min	

#### • Servicing Entretien

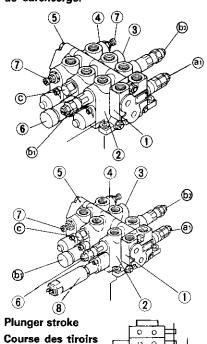
ltem <i>Elément</i>	- 1	Reference values for new vehicle Valeurs de reférence pour vehicule neuf	Service limit values Valeurs limite de service	Remarks Observations
Gear track wear Usure de voie de pignon	Clearance Jeu	0.02 in 0.05 mm	0.066 in 0.15 mm	Up to +0.1 mm (+0.004 in) Jusqu' à +0,1 mm
Gear track wear Usure de voie de pignon	Scratch by gear teeth Rayure par dent de pignon	1/3	1/2	Circumferential Circonférentiel
Shaft/bushing wear Usure d'arbre/manchon	Clearance Jeu	0.004 in 0.1 mm >	0.008 in 0.2 mm	_
Bushing wear (left and right) Usure de manchon (gauche et droit)	Length Longueur	_	0.005 in 0.12 mm	

#### b. Control valve Valve de contrôle

• Specifications Caractéristiques

Variety <i>Variéte</i>	Unit <i>Unité</i>	R510 (E	3)	
Maker Fabricant		Kayaba	<b>a</b>	
Type Type			KVS-65.	J-3
Flow rate <i>Débit</i>		gal/min <i>l/min</i>	17.17 65	
Max. adjustable pressure Pression max.		psi <i>kgf/cm</i> ²	2985 210	
Allowable back pressure Pression admise dans le retour		psi <i>kgf/cm</i> ²	213 15	
Main relief pressure Pression de décompression principale	Bench set pressure Pression au banc d'essai	psi <i>kgf/cm</i> ²	2490 ± 40 175 ± 3	2915 ±70 205 ±5 🔨
	Actual port pressure Pression réelle sur lavalve	psi kgf/cm²	2775 ± 70 195 ± 5	
Overload relief pressure Pression de décompression de surcharge	Bench set pressure Pression au banc d'essai	psi kgf/cm²	3270 ± 70 230 ± 5	
	Actual port pressure A  Pression réelle A	psi kgf/cm²	3625 ± 1 255 ± 1	
Parts No. <i>Pièce No.</i>	STD/ Auto leveler		68861-6131-2/6	8881-6161-0
Assy seal Part No. of control valve	Lift		68811-9390-2	
Ensemble de joint Pièce No.	Tilt/Service port		68811-938	30-0
	Shut off valve		68811-942	20-0

- Valve section and relief valve arrangement
- Section de valve et disposition des clapets de surchcerge.



Control valve

Soupape de contrôle

VI-02

- 1) Inlet section
- 2 Tilt section
- (3) Lift section
- 4 Service port
- 5 To backhoe attachment
- 6 Detent
- 7 Shut off plug (valve)
- 8 Solenoid valve
- (a) Main relief valve
- (b) Overload relief valve for rod side
- (b) Overload relief valve for bottom side
- (c) Anti-cavitation valve
- <Return spring force> <Force du ressort de retour>

Section Section	Model Modéle	Neutral Point mort	Full stroke Course totale	Detent release Débrayage d'organe d'ar
Tilt, Service port Inclinaison, valve auxilliaire.	R510 (B)	18.1 lbf (8.2 kgf)	24.7 lbf (11.2 kgf)	
Lift <i>Levage</i>	R510 (B)	15.7 lbf (7.1 kgf)	28.2 lbf (12.8 kgf)	39.7 ~ 66.1 lb (18 ~ 30 kgf)

1) Section admission

(2) Section inclinaison

(3) Section levage

(4) Orifice service

(5) a la rétrocaueuse

(8) Électrovanne

7 Prise obturation (soupape)

Soupape anti-cevitotion

(al) Soupape de décharge principale

(bl) Soupape de décharge pour surcharge co

52 Soupape de décharge pour surcharge côté ba

6 Détente

<Plunger stroke> < Course des tiroirs:

changer strokes course des tronss						
(A)Push	B)Pull	© Detent				
0.28 in (7.2 mm)	0.28 in (7.2 mm)	0.22 in (5.6 mm)				

# c. Cylinder Cylindre

• Specifications Caractéristiques

	Model		R510	) (B)
	Cylinder Cylindre Item Elément	Unit <i>Unité</i>	Lift Levée	Tilt Inclinaison
	Maker Fabricant		Zenowa	Zenowa
ne	Type Type		70-40-626	80-45-412
Cylindre hydraulique	Cylinder inside dia.  Dia. intérieur de cylindre	in <i>mm</i>	2.76 70	3.15 80
lindre h	Piston rod outside dia. Dia. extérieur de tige de piston	in <i>mm</i>	1.57 40	1.77 45
Š	Stroke Course	in <i>mm</i>	24.65 626	16.22 412
	Min retraction length (pitch)  Longueur de contraction min (pas)	in <i>mm</i>	36.73 ± 0.12 933 ± 3	32.48 ± 0.12 825 ± 3
ylinder	Bushing inside dia. (at rod) Dia. intérieur de manchon (à la tige)	in mm	1.57 +0.008 +0.004 40 +0.1	1.57 <sup>+0.01</sup> +0.002 40 <sup>+0.25</sup> +0.05
Hydraulic cylinder	Bushing inside dia. (at bottom) Dia. intérieur de manchon (au bas)	in mm	1.57 +0.01 +0.002 40 +0.25 +0.05	1.57 +0.01 +0.002 40 +0.25 +0.06
Ť	Part No. <i>Pièce No.</i>		© 68881-7211-1 ® 68881-7215-1	68881-7221-1
	Assy seal Part No. Ensemble de joint Pièce No.		68881-9320-1	68881-9330-1

Cylinder	Lift	Tilt
Cylindre	Levée	Inclination
Cylinder head screw size  Taille de vis culasse de cylindre	M75 x 2	M85 x 2
Tightening torque	557 ± 5.6 ft.lbs	521 ± 5.2 ft.lbs
Couple de serrage	(55 ± 5.5 kgf.m)	(72 ± 7.2 kgf.m)
Cylinder rod screw size Taille de vis, bielle du cylindre	M27 x 3	M30 x 3
Tightening torque	456 ± 4.6 ft.lbs	579 ± 5.8 ft.lbs
Couple de serrage	$(63 \pm 6.3 \text{ kgf.m})$	(80 ± 8.0 kgf.m)
Wrench size Taille de clé	41 mm	46 mm

## d. Operating speed Vitesse de fonctionnement

1 Cylinder Cylindre

Unit: second Unité: seconde

ltem <i>Elément</i>		Reference values for new vehicle  Valeurs de référence  pour véhicule neuf	Service limit values Valeurs limite de service	Remarks Remarques
	Model	R510	R510	
Lift upper Levèe superieur		5.1 ± 0.5	6.7	Highest above ground level Le plus haut au-dessus du
	lower inférieure	3.4 ± 0.5	4.7	niveau du sol
Tilt Inclinaison	tilt inclinaison	1.1 ± 0.3	1.7	Horizontal to tilt on ground level De Horizontala in cliné sur une surface plate
	dump déverser	1.0 ± 0.3	1.6	Full tilt to dump at max height De complétement inclinéjusque au déversement ceu a hoseiteer maximum.

#### e. Natural fall amount Montant de chute de gravité

	Unit <i>Unité</i>		Reference values for new vehicle Valeurs de référence pour véhicule neuf	Service limit values Valeurs limite de service	Remarks <i>Remarques</i>
Cylinder natural fall Chute par gravité de cylindre	in/min mm/min	Tilt Inclinaison	0.8 20	3.9 100	
	in/min mm/min	Lift Levée	0.8 20	3.9 100	
Piston rod deformation  Déformation de tige de piston	in <i>mm</i>		0.002> 0.05>	0.02 0.5	
Rod/bushing wear Usure de tige/manchon	in <i>mm</i>	Clearance Dèversement	0.01> 0.25>	0.016 0.4	
Tube/piston ring wear Usure de segment de piston/tube	in <i>mm</i>		0.002~0.0011 0.05~0.03	0.024 0.6	

# f. Lever stroke and operating force Course du levier et force de fonctionnement

ltem <i>Elément</i>	Operating force (lb) Force de fonctionnement (kgf)	Stroke (in) Course (mm)
Model Modéle	R510	R510
Lift lever Levier de levée	5.29 ± 1.1 2.4 ± 0.5	2.36 ± 0.79 60 ± 20
Tilt/Dump lever Levier de l'inclinaison/deversement	4.41 ± 1.1 2.0 ± 0.5	2.36 ± 0.79 60 ± 20
Float Flottaison	11.9 ± 4.41 5.4 ± 2.0	1.77 ± 0.79 45 ± 20
Service port lever Levier de sortie auxilliceire		

Note: Stroke excludes the lever play of 0.79 in. (20 mm). *Remarque: La course comprend un jeu de levier de 20 mm*.

#### g. Front shovel installation Installation de la pelle avant

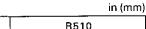
- (1) Front frame, Chassis avant
- 2 Pin, Goupille
- Grease nipple, Graisseur
  Key plate, Plaque clef
  Pin, Goupille

in (mm)

	R510	
а	25.79 (655)	
b	2.28 (58)	
С	2.05 (52)	
d	4.02 (102)	
<b>(A)</b>	φ1.97 <sup>+0.004</sup> <sub>+0.005</sub> (50 <sup>+0.10</sup> <sub>+0.05</sub> )	
₿	® ø1.57 +0.04 +0.1 5	
0	φ1.57 <sup>+0.04</sup> <sub>+0.002</sub> (40 <sup>+0.1</sup> <sub>+0.05</sub> )	

- 8 Bushing, Baque
  9 Bushing, Baque

- Dust seal, Bague joint a poussière
  Shim 1.0, Cale 1.0



!	R510				
е	2.17 (55)				
f	46.85 (1190)				
g	86.69 (2202)				
h	6.14 (156)				
0	φ1.97 <sup>+0.006</sup> <sub>+0.05</sub> (50 <sup>+0.55</sup> <sub>+0.05</sub> )				

- Tilt arm, Bras de inclinaison
- Bushing, Bague
  Shim 2, Cale 2
- Pin, Goupille
- Bushing, Bague
- Dust seal, Bague joint a poussière
- Shim 1.0, Cale 1.0
- Tilt link, Maillon d-inclinaison (21)

in (mm)

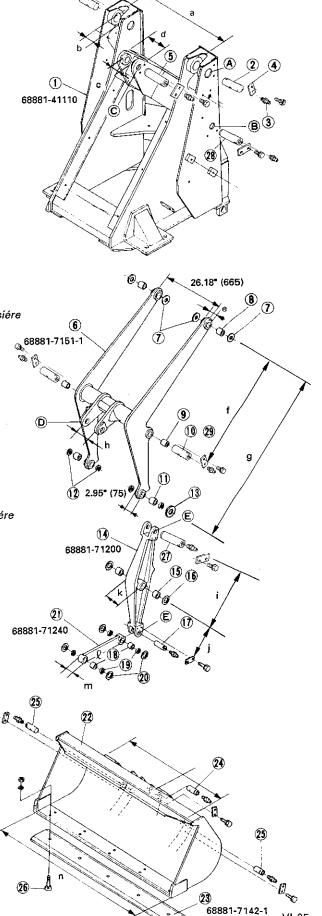
	R510			
i	24.02 (610)			
j	22.05 (560)			
k	6.08 (154)			
	17.91 (455)			
m	2.95 (75)			
Ē	© ø1.77 <sup>+0.04</sup> <sub>+0.002</sub> (45 <sup>+0.10</sup> <sub>+0.05</sub> )			

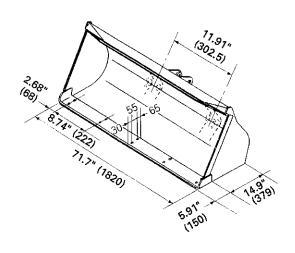
- Shovel bucket, Godet Bolt, Vis Cutting edge, Plaque d'asure Pin, Goupille
- Pin, Goupille
  Pin, Goupille

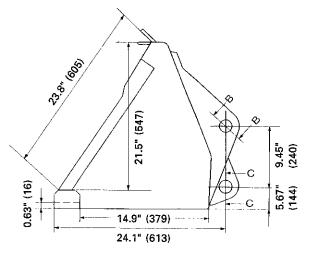
- Pin, Goupille
- Pin, Goupille

in (mm)

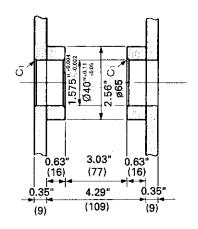
	R510		
n	66.54 (1690)		
0	6.10 (155)		



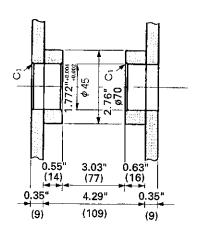




<Sect. B-B>



<Sect. C-C>



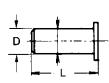
	Pin <i>Goupille</i>	Bushing <i>Bague</i>	
Material <i>Matériau</i>	S45C-D (JIS)	STKM16A or S43C	
Heat treatment Traitement thermique	High frequency Induction hardening  Trempe par induction à haute fréquence	-	
Surface Hardness Trempe superficielle	HRC 52 ~ 59	HRC 52 ∼ 59	
Effective hardness depth Profondeur de trempe réelle	0.08 ~ 0.16 in (2 ~ 4 mm)	0.04 ~ 0.08 in (1 ~ 2 mm)	

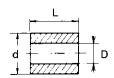
Note: 23 Cutting edge: Material is S50C

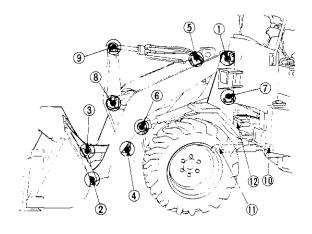
Hardness HB207 ~ 248.

Nota: 23 côté tranchant: Le matériau est S50C. Trempe HB 207-248.

#### h. Front pin, Front bush Cheville avant, Coussinet avant







Unit: in Unité: (mm)

				Unite: (mm	
	Reference pin dimensions  Dimension de référence des goupilles  Pin diameter D × Length L in  Diamétredes goupilles x Longueur (mm)		Reference bushing dimensions  Dimensions de référence des manchons  Outside diameter d × Inside diameter D×Length L in  Diamétre intétre extérieur x Longucur (mm)		
Model	R510		R510		
①	68881-71150	1.97 x 5.75 (50 x 146)	68881-71130	1.97 x 1.57 x 2.05 (50 x 40 x 52)	
2	68811-71260	1.57 x 5.71 (40 x 145)	68811-71130	1.97 × 1.57 × 2.05 (50 × 40 × 52)	
3	68881-71150	<b>↑</b>	68881-71290	2.17 x 1.77 x 2.56 (55 x 45 x 65)	
4	1	<b>↑</b>	1	<b>↑</b>	
\$	68881-71260	1.57 x 4.69 (40 x 119)	68881-93460	Tilt cylinder 1.97 x 1.57 x 1.97 Cylinder d'inclinaison (50 x 40 x 50	
6	68881-72130	1.57 × 4.37 (40 × 111)	68811-71120	2.36 × 1.57 × 2.17 (60 × 40 × 55)	
<b>①</b>	68881-72120	1.57 × 5.55 (40 × 141)	68881-93460	Lift cylinder 1.97 x 1.57 x 1.97 Cylindre de levage (50 x 40 x 50)	
8	68881-71230	1.97 x 10.0 (50 x 254)	68881-71272	2.56 x 1.97 x 1.97 (65 x 50 x 50)	
9	68811-71260	1.57 × 5.71 (40 × 145)	68881-93660 C	Tilt cylinder 2.17 x 1.57 x 1.9 ylinder d'inclinaison (55 x 40 x 50)	
10	68881-34830	1.38 x 4.41 (35 x 112)	60001 02260	Steering cylinder 1.77 $\times$ 1.38 $\times$ 1.7 $\text{Cylindre de direction}$ (45 $\times$ 35 $\times$ 45)	
0	<b>↑</b>	<b>↑</b>	68881-93260 C	Steering cylinder 1.77 $\times$ 1.38 $\times$ 1.7 $\times$ 1.38 $\times$ 1.7 $\times$ 1.45 $\times$ 35 $\times$ 45)	
12	68881-41170	3.15 <sup>-0.002</sup> / <sub>-0.07</sub> × 11.42 (80 <sup>-0.07</sup> / <sub>-0.07</sub> × 290)	68881-41150	3.15 -0.005 -0.005 x 3.70 x 1.97 (80 -0.005 x 94 x 70)	
Service limit Limite de service	Up to -0.039 in of pin diameter Jusque' à -1,0 mm du diamètre de goupille		Up to +0.039 in of inside diameter  Jusque' à +1,0 mm du diamètre intérieur		

#### <Note>

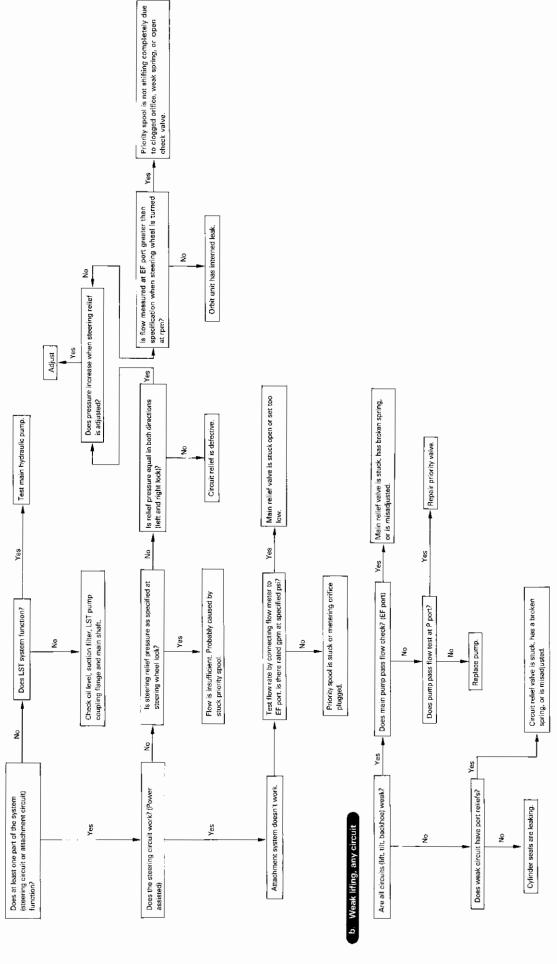
1. New part tolerance To lérance de piéce neuve

Pin D:  $1.378 \stackrel{0.0020}{-0.0027} (35 \stackrel{-0.05}{-0.07}), 1.575 \stackrel{0.0020}{-0.0027} (40 \stackrel{-0.05}{-0.07})$ Goupille D:  $1.772 \stackrel{-0.0020}{-0.0027} (45 \stackrel{-0.05}{-0.07}), 1.969 \stackrel{0.0027}{-0.0027} (50 \stackrel{-0.05}{-0.07})$  Bush D:  $1.378 \stackrel{-0.0114}{-0.0106} (35 \stackrel{-0.29}{-0.27}), 1.575 \stackrel{-0.0114}{-0.0106} (40 \stackrel{-0.290}{-0.270})$  $1.772 \stackrel{-0.0114}{-0.0106} (45 \stackrel{-0.290}{-0.270}), 1.969 \stackrel{-0.0106}{-0.0106} (50 \stackrel{-0.290}{-0.270})$ 

VI-08

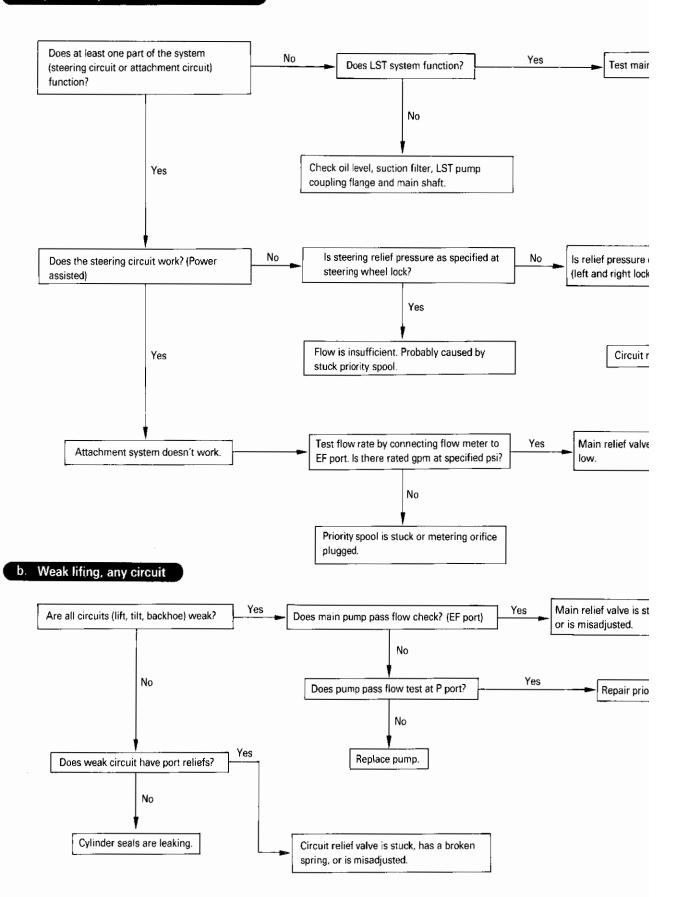
# B. Troubleshooting

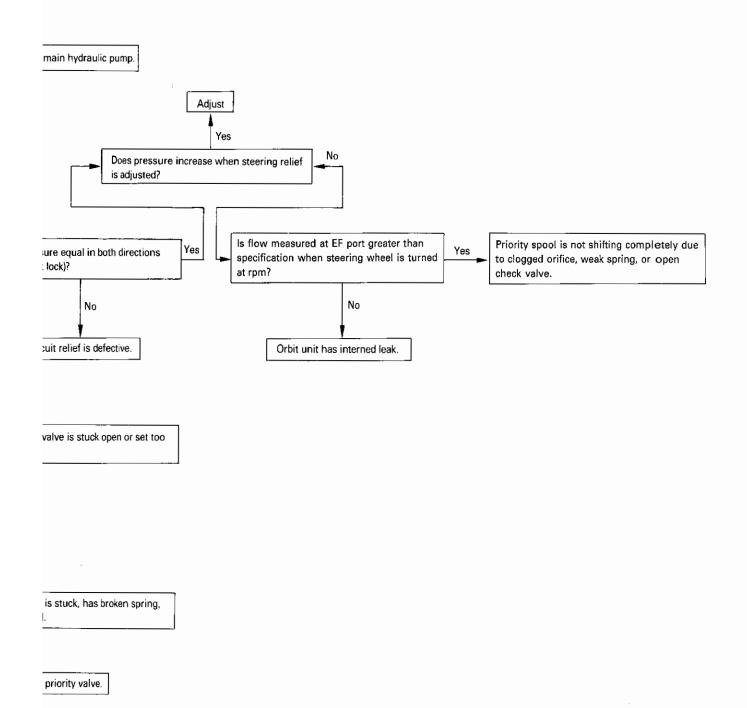
a. Hydraulic system does not work



#### B. Troubleshooting

#### a. Hydraulic system does not work





## C. Testing & Adjustment

#### a. Main relief pressure

#### <Procedure>

- Set the pressure gauge on the main pump as shown in photo.
- 2. Start the engine and check the measurement circuit.
- 3. With the engine running at max rated speed, operate the lever to relieve the cylinder.
  - Repeat this operation two or three times to achieve an accurate value.
- If the measured value does not comply with the specified value, adjust the preessure (at an oil temperature of 113±41°F, 45±5°C).
  - (1) Main pump (2) Pressure port

#### <Specification>

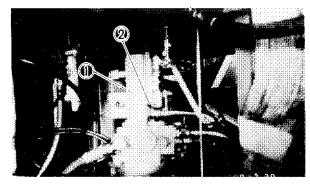
psi kgf/cm²

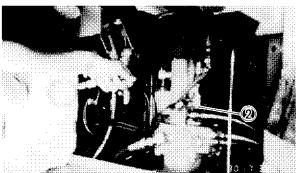
	R510
Actual port pressure	2275 ± 140
	195 $\pm$ 10
Bench set pressure	2490 <sup>-40</sup> -so
	175 🛂

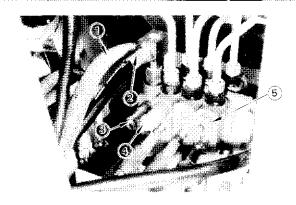
- Main relief valve location
  - 1 Inlet hose
  - 2 Return hose
  - (3) Main relief valve
  - 4 Overload relief valve for tilt cylinder
  - Shut-off valve

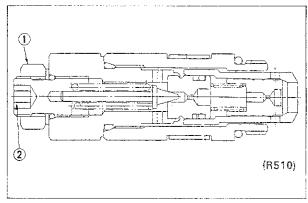
#### <Adjustment>

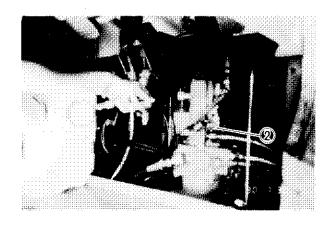
- 1. Loosen the lock nut ①.
- Tighten or return the adjusting screw ② while relieving.
   Pressure increases or decreases approx. 355 psi (25 kgf/cm²) per every 45 degree.











# b. Overload relief pressure A

(Main relief pressure over-adjusting method)

#### <Procedure>

- Remove the delivery side adaptor plug and set a pressure gauge.
- 2. Adjust the set pressure at the main relief valves to approximately 0.98 MPa (10kgf/cm<sup>2</sup>, 142.2 psi) higher than the set pressure for the overload relief valve.
- Relieve cylinder at maximum rated engine rpm and read the gauge.
- 4. Repeat this step several times to insure correct readings.
- If the measurement is outside the specification, readjust.
- Reduce the main relief valve set pressure to the specified PSI

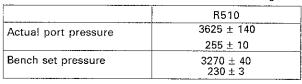
#### <Condition>

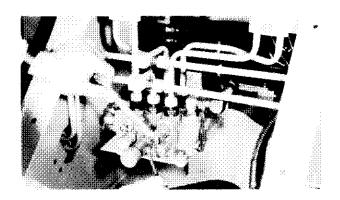
• Oil temp.:  $113 \pm 41^{\circ}F$  ( $45 \pm 5^{\circ}C$ )

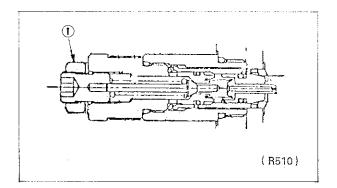
Engine: Max. rated 2600 rpm



kgf/cm<sup>2</sup>







#### <Adjusting>

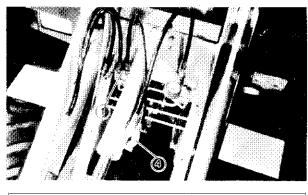
- 1. If the measured value doesn't comply with the specified value, readjust the pressure.
  - Every 45° turn increases or decreases the pressure value of  $285 \sim 355 \text{ psi } (20 \sim 25 \text{ kgf/cm}^2).$
- Be sure to check the pressure value after tightening the lock nut 🛈 .

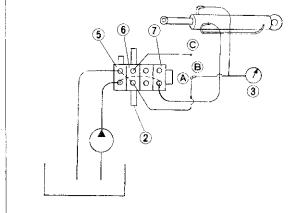
## c. Overload relief pressure B

(Cylinder's area differential method)

#### <Procedure>

- Install the pressure gauge and plumbing as shown in photo.
   ⊕ B
  - Service port
  - 2 Overload relief valve
  - 3 Pressure gauge
  - 4 Tilt cylinder port
- 2. Shift the service port lever with its half port to supply the pump flow to the bottom side of tilt cylinder.
- Read the pressure gauge while shovel bucket is tilting.
  - (5) Inlet section
  - 6 Tilt section
  - 7 Service port section
- 4. Swap the gauge from port (A) to (B) to measure the other overload relief valve.
- 5. When retracting the cylinder, shift the service port lever and tilt lever simultaneously.





#### <Condition>

• Oil temp.:  $113 \pm 41^{\circ}$ F ( $45 \pm 5^{\circ}$ C)

Engine: Max. rated 2600 rpm.

#### <Specification>

psi

kgf/cm<sup>2</sup>

	R510
Actual port pressure	3625 ± 140
	255 ± 10
Bench set pressure	3270 ± 40 230 ± 3

#### <Adjusting>

- If the measured value doesn't comply with the specified value, readjust the pressure. Every 45° tun increases or decreases the pressure value of approx. 285 ~ 355 psi (20 ~ 25 kgf/cm²).
- Be sure to check the pressure value after tightening the lock nut.

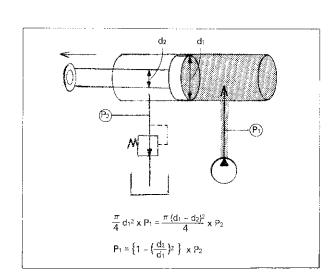
#### Example: Tilt cylinder (R510)

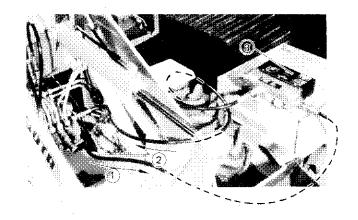
$$(d1 = 80 \text{ mm}, d2 = 45 \text{ mm}, P2 = 230 \text{ kgf/cm}^2)$$

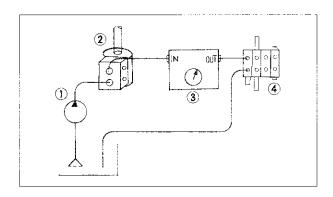
P1 = 
$$\{1 - (\frac{4.5}{8.0})^2\} \times 230 = 157 \text{ kgf/cm}^2$$

Pump pressure rises up to 157 kgf/cm<sup>2</sup>.

This means that main relief valve isn't required to be readjusted over gear pump's max. pressure.







#### c. Hydraulic pump flow rate measurement

#### <Procedure>

- Connect the flow meter between EF port of the steering controller and control valve inlet port. Be careful not to connect the wrong hoses.
- 2. Open the loading valve of the flow meter to start the engine.
- 3. Increase the engine speed to the max. rated speed.
- While slowly closing the loading valve, apply the rated load pressure (test pressure) to the pump.
- 5. Measure the discharge and pump rpm (engine rpm).
- Calculate the volumetric efficiency and judge the usability of the pump.
  - ① From EF port
  - 2 To control valve inlet port
  - (3) Flow meter

#### <Condition>

• Oil temp.: 113 ± 41°F (45 ± 5°C)

• Engine: Max. rated (2600 rpm) when no load.

#### [Calculation of volumetric efficiency]

(1) Conversion of the measured value into one revolution of the pump.

Discharge at the rated load (cc/rev) 

Measured discharge (\(\ell/\)min.) × 1000

Measured pump speed (rpm)

(2) Calculation of volumetric efficiency ( $\eta_{\nu}$ )

$$\eta_{\rm v} = -\frac{{\rm Discharge\ at\ rated\ load}}{{\rm Theoretical\ discharge}} \times 100 \, (\%)$$

#### <Specification>

gal/min (l/min)

			J
			R510
Flow rate	Theoretical x 2600 rpm		15.73 (59.54)
	Factory spec.	No load 355 psi (25kgf/cm²)	15.6 ± 0.3 (58.9 ± 1.3)
	x 2600 rpm	Load 2775 psi (195 kgf/cm²)	14.9 ± 0.3 (56.3 ± 1.3)
	Service limi (80%)	t Load	12.45 (47.1)
Loading	pressure		2775 ± 70 psi (195 ± 5 kgf/cm²)

#### d. Operating speed

#### <Points>

- 1. Measure time required for a below condition with a standard front attachment and no load.
- 2. Take several measurements and base evaluation on the average value.
- 3. Assure safety around the machine during inspection.

#### <Conditions>

- 1. Measure speeds at max rated engine rpm.
- 2. Temperature of hydraulic oil:  $113\pm41^{\circ}F$
- 3. Test on the flat ground.
- 4. Take measurements after repeating respective operations at no load several times.

#### 1. Dumping speed (Tilt cylinder)

- 1. Fully extend the lift cylinder.
- 2. Run the engine at the maximum speed.
- 3. Measure the time required for the cylinder to move a full stroke.
  - No bucket load.

sec.

A	В
1.0 ± 0.3	1.6

#### 2. Crowd speed (Tilt cylinder)

- 1. Place the shovel bucket slightly above the ground level with horizontal condition.
- 2. Shift the tilt lever fully and measure the time required.

sec.

А	В
1.1 ± 0.3	1.7

#### - -

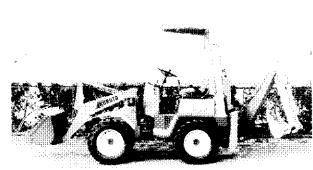
#### 3. Lift cylinder, raising and down time.

- 1. Ground the shovel bucket.
- 2. Run the engine at the maximum speed.
- 3. Measure the time required for the lift cylinder to move from the ground to the upper end of the cylinder.

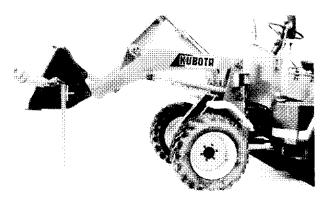
sec.

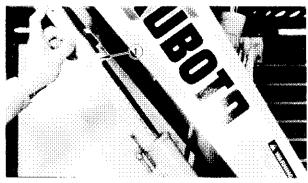
	А	В
up	5.1 ± 0.5	6.7
down	$3.4 \pm 0.5$	4.7

No bucket load.









## e. Spontaneous fall of the cylinder

- 1. Set the machine as shown in the photograph at left.
- 2. Mark the bucket to measure the height.
- 3. Mark the cylinder rod with a pencil or other tool.
- 4. Measure the difference in height 10 minutes later.
  - No bucket load.
  - Engine stop.
  - Oil temp. must be 113 $\pm$ 41°F (45  $\pm$  5°C)

in (mm)

	Reference values for new vehicle Valeurs de référence pour véhicule neuf	Service limit values Valeurs de limite de service	
Tilt	0.8	3.9	
Inclinaison	20	100	
Lift	0.8	3.9	
Levée	20	100	

1 Reference mark

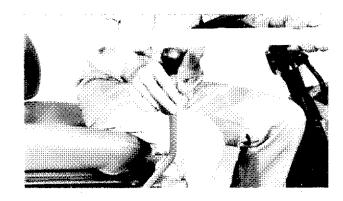
#### f. Operating lever function

#### 1. Lever stroke and play.

- 1. Secure a scale to the side of the control lever.
- 2. Measure lever stroke and play. (Stroke doesn't include the play.)
  - · Lever control force should be the reference value.

in (mm)

Tilt	2.36 ± 0.79
	(60 ± 20)
Ligy	2.36 ± 0.79
	$(60\pm20)$
Float	1.77 ± 0.79
	(45 ± 20)
Service port	



#### <Adjustment>

- · Adjust the lever stroke by rod end.
- When lever play is excessive, check rod end nut, fulcrum pin, needle bearing, steering arm etc.

#### 2. Lever control force

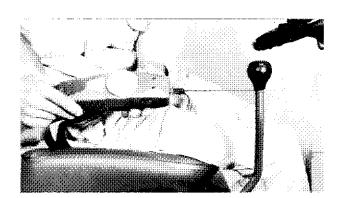
- 1. Measure the control force by hooking a spring balancer to the control lever as shown in photo.
- 2. Read the dial point just before the stroke end.
  - Before measuring, shift the lever several times.

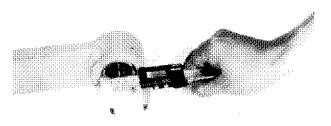
lbw. (kgf)

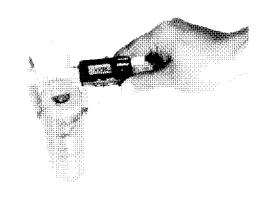
Tilt	5.29 ± 1.1
	$(2.4 \pm 0.5)$
Lift	14.47 ± 1.1
	$(2.0 \pm 0.5)$
Float	11.9 ± 4.41
	$(5.4 \pm 2.0)$
Service port	

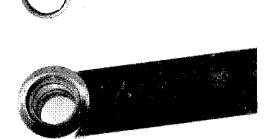
#### <Adjustment>

 If the lever control force is out of specification, check cable installation, rust of cable or linkage and spool return spring.







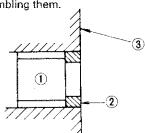


#### g. Pin and bushing wear.

- 1. Measure the outer diameter of the pin using an outside micrometer or vernier calipers. This is dimension A.
- 2. Measure the inner diameter of the bushing using an inside micrometer or vernier calipers. This is dimension B.
- 3. B-A is the pin/bushing clearance Limit ..... Clearance: 0.08 in (2.0 mm) Pin itself (0.D.) ..... Up to -0.04 in (-1.0 mm) Bushing itself (I.D.) ..... Up to +0.04 in (+1.0 mm)
- 4. Make sure that grease comes out of the grease hole.
- 5. Make sure that the grease nipple is not damaged.

#### (When reassembling)

Apply grease to the bushing and dust seal when reassembling them.

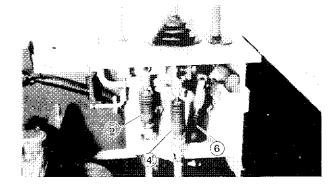


- 1 Bushing
- 2 Dust seal
- 3 Be sure that the dust seal does not protrude from this surface.

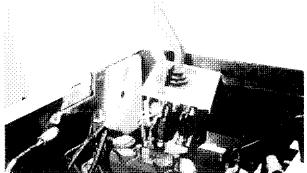
## D. Servicing

## a. Operating lever removing

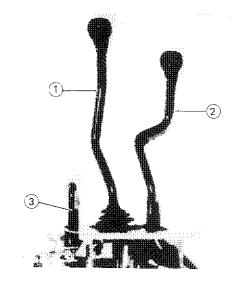
- ① Control lever 1 (Main)
- 2 Control lever 2 (Service port)
- 3 Lock lever
- (4) Control cable (Lift)
- (5) Control cable (Tilt)
- (6) Control cable (Service port)
- (7) Needle bearing
- 8 Steering arm
- 9 Fulcrum pin
- 10 Ball bearing
- (1) Needle bearing
- 12) Fulcrum pin
- (13) Bolt
- (14) Link
- 15 Lock lever comp.
- 16 Spring
- 1. Remove the battery.
- 2. Disconnect the control cables.
  - 4 Control cable (Lift) 68841-6521-0
  - 5 Control cable (Tilt) 68881-6521-0
  - (6) Control cable (Service port) 68841-6521-0

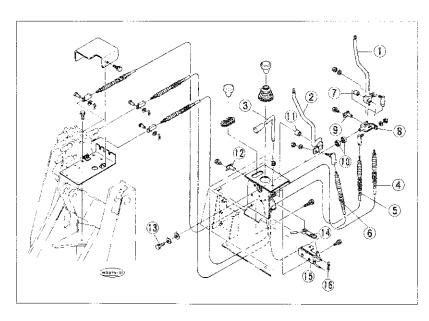


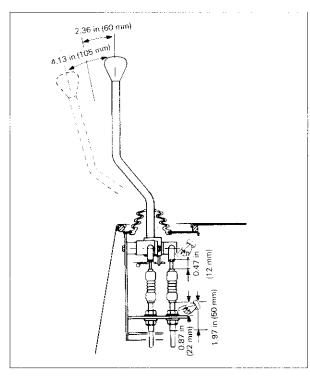
Loosen the four mounting bofts and remove the operation levers and bracket as assy.

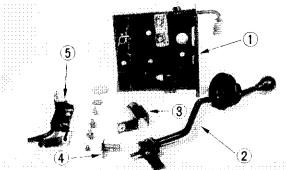


4. Loosen the bolt (3) and remove the control lever (1).









#### (When reassembling)



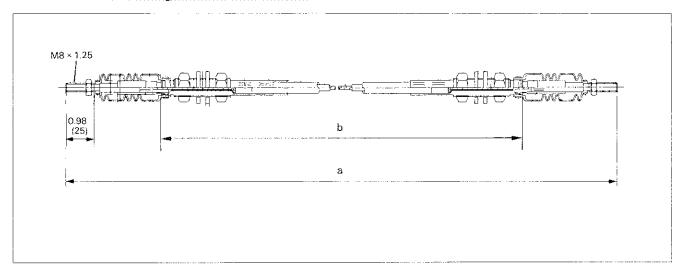
Adjust the cable end length to 0.47 in (12 mm) between rod end and cable upper nut.

Adjust the distance to 0.87 in (22 mm) between bracket and cable lower nut.

- Rod end or control cable must be free from extra force after tightening lock nut.
- Control cable must be passed under LST pump to control valve
- Be sure that safety lever lock works properly.
- When installing the cable, bending radius should be more than 7.87 in (200 mm).
- Cable length (All three are same.): 70.1 in (1780 mm)

- (1) Bracket assy
- 2 Control lever 1
- (3) Control arm
- (4) Fulcum pin
- (5) Safety lock lever assy

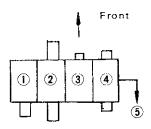
Cable length	а	b
Lift, service port	62.2" (1580)	55.6" ± 0.2 (1411 ± 5)
Tilt	66.9" (1700)	60.3" ± 0.2 (1531 ± 5)



#### b. Control valve

#### (1) Parts designation

- 1 Inlet section
- 2 Tilt circuit
- 3 Lift circuit
- (4) Service port
- 5 To backhoe attachment
- a1: Main relief valve
- b1: Overload relief valve for rod side
- b2: Overload relief valve for bottom side
- c: Anti-cavitation valve
- d: Shut off plug (valve)



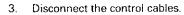
#### (2) Removing & reinstalling

1. Place the shovel bucket on the ground.



Stop the engine and relieve the residual pressure by operating the levers.

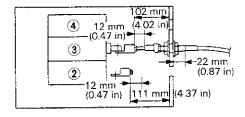
2. Remove the front cover.



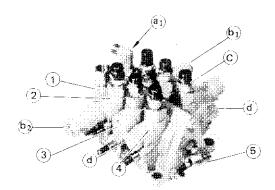
(After reassembling)

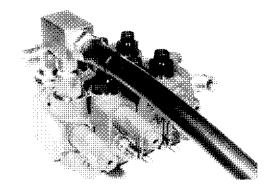
Check cable movement by operating the levers.

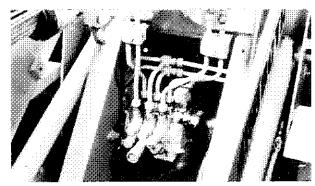
- (2) Tilt
- 3 Lift
- 4 Service port

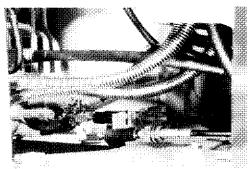


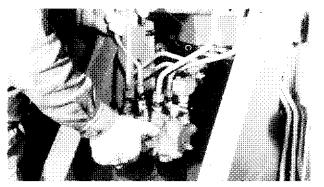
Remove the mounting bolts and take out the valve assy.











# Section VII

# **Backhoe**

## ——— CONTENTS ———

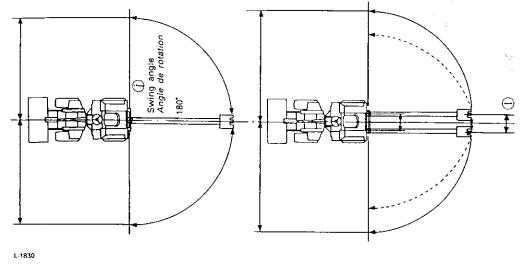
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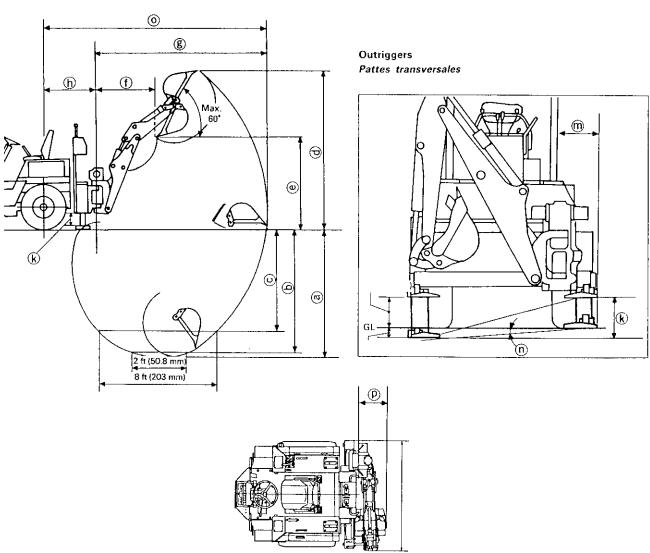
# A. Specification Données techniques

## a. General dimension Dimensions générales

in (mm)

	ltem Pièce	R510 (B)
(a)	Digging depth, Max.  Profondeur max. d'excavation de terre	108.3 (2750)
<b>(b)</b>	Digging depth, Max. (2' flat bottom)  Profondeur max. d'excavation de terre (fond plate de 2')	107.3 (2725)
©	Digging depth, Max. (8' flat bottom)  Profondeur max. d'excavation de terre (fond plat de 8')	89.0 (2260)
<b>@</b>	Overall operating height (Full raised) Hauteur de manoeuvre totale (complètement relevee)	126.8 (3220)
e	Loading height, Max. Hauteur de chargement max.	80.3 (2040)
<b>①</b>	Loading reach, Max. Rayon d'action de chargement max.	61.4 (1560)
9	Reach from centerline of swing pivot Rayon d'action à partir de l'axe du pivot de rotation	145.7 (3700)
h	Swing pivot to rear wheels  Pivot de rotation aux roues arrières	36.0 (915)
①	Bucket rotation Rotation du godet de pelle	180°
Θ	Swing arc, Max.  Angle de rotation max.	180°
<b>®</b>	Hydraulic stabilizer stroke Course du stabilisateur hydraulique	19.88 (505)
0	Side shift stabilizer spread Divergence du stabilisateur en déplacement latéral	39.4 (1000)
100	Wall clearance Intervalle mural	12.6 (320)
n	Leveling angle Angle de nivellement	10.1°
0	Reach from centerline of rear axle Rayon d'action à partir de l'axe de l'essieu arrière	181.7 (4615)
Ð	Transport overhang from centerline of swing pivot Porte-à-faux du transport à partir de l'axe de pivot de rotation	10.4 (265)
<b>9</b>	Undercut from centerline of swing pivot Evidement à partir de l'axe du pivot de rotation	27.2 (690)
0	Bucket model used for measurements Modèle de godet utilisé pour les mesurages	17.7 (450)
(3)	Backhoe assy weight Poids de la rétrocaveuse	1653 lbf (750 kgf)





## b. Operating performance

Performance de fonctionnement

ltem <i>Pièce</i>	R510 (B)	
a: Bucket model used for measurement Modéle de godet utilisé pour les mes	-	17.7" (450 mm)
b: Digging force using Bucket cylinder (\$\frac{5}{2}\) Force de cavage utilisant le vérin du godet (\$\frac{5}{2}\)	·	3780 lbf (1715 kgf)
c: Digging force using Arm cylinder (SA Force de cavage utilisant le vérin du bras (SA	•	2535 lbf (1150 kgf)
d: Lift capacity using boom cylinder (SA Capacité de levage utilisant le vérin du bras (S	908 lbf (412 kgf)	
e: Lift capacity using arm cylinder (SAE Capacité de levage utilisant le vérin du bras (S	935 lbf (424 kgf)	
f: Swing time (Full Turn)  Durée de rotation (rotation totale)		3.4 sec.
g: Lifting time (Arm cylinder only)  Durée de levage (vérin du bras seu	ulement)	2.1 sec.
h: Lifting time (Boom cylinder only)  Durée de levage (vérin de la fléche se	eulement)	1.8 sec.
i: Bucket operating time Durée de roulement du godet		
	Dump Déversement	1.3 sec.
j: Swing force Force de rotation	2951 lbf.ft (408 kgf.m)	

Note: Engine speed should be adjusted to 1600 rpm Nota: La vitesse de moteur doit être ajustée à tr/min.

#### c. Lifting capacity (Backhoe)

- Lift capacity figures on this chart are 87 % of the maximum lift force per SAE Definition J31 and J49 at 2490 psi (175 kgf/cm²) system relief pressure and does not exceed 75 % of the machine tipping load.
- Top numbers—lift capacity within 45° either side of prime mover.
- Bottom numbers—lift capacity anywhere within full swing are
- Figures stated are determined by static tests and do not include dynamic factor.

Machine conditions: Standard bucket, all else according to standard specifications.

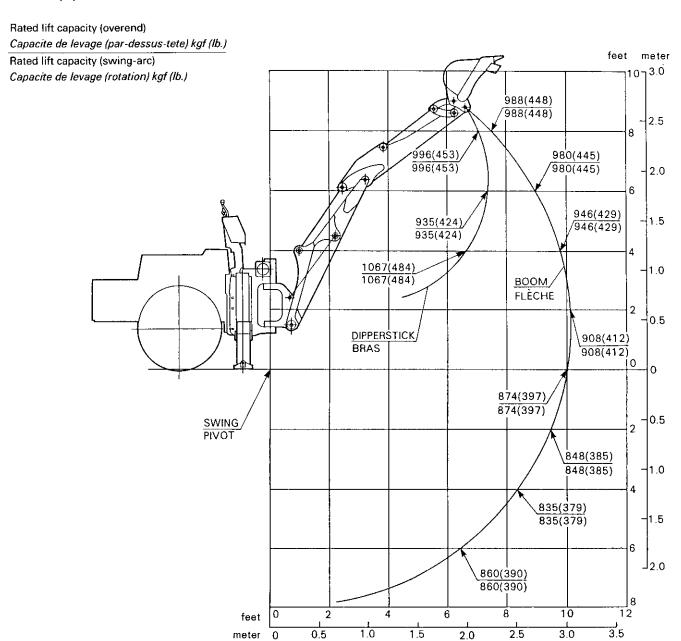
Outrigger:

#### c. Capacite de levage (Retrocaveuse)

- Les valeurs de capacité de levage dans ce tableau correspondent à 87 % de la force de levage maximum selon la définition SAE J31 et J49 à une pression de dècompression du circuit de 175 kgf/cm² et ne dépassent pas 75 % de la charge de renversement de la machine.
- Chiffres supérieurs Capacité de levage dans les 45° de l'un des côtés du pivot.
- Chiffres inférieurs Capacitéde levage sur tout l'arc de rotation.
- Les chiffres énumérés sont déterminés par des essais statiques et ne comprennent pas de facteur dynamique.

Conditions de la machine: Godet standard et le reste selon les spécifications standards.

#### < R510(B) >



# d. Hydraulic system data Données sur le système hydraulique

# 1. Gear pump (Main) Pompe à engrenages

Même pompe que pour le chargeur et le systéme de direction.

#### • Specifications Caractéristiques

Model / Modéle	R510 (B)
Pump type Type de pompe	Tandem gear type Type à engrenages tandem
Maker Fabricant	Nippon Spindle <i>Broche Nippon</i>
Max. durable pressure Pression max.	2490 psi (175 kgf/cm²)
Part No. Piece No.	
Assy seal part No.  Ensemble de joint pièce No.	

# • Delivery rate Taux de refoulement

Model / Modéle	R510 (B)		
Theoretical discharge capacity Capacité de décharge théorique	1.40 in²/rev (22.9 cc/rev)		
Engine: 2600 RPM	15.7 gal/min (59.54ℓ /min)		
Recommended allowable limit (85 %) Limite antrorisée recommandée	13.4 gal/min (50.6 ℓ min)		
Service limit (80 %) Valeurs de limite de service	12.6 gal/min (47.6 ½/min)		

#### Factory specifications

	Model / <i>Modéle</i>	R510 (B)
No load A vide	355 psi (25 kgf/cm²)	15.6 $\pm$ 0.3 gal/min (58.9 $\pm$ 1.3 l / min) or more
Load <i>En charge</i>	2775 psi (195 kgf/cm²): 95% ≤	14.9 ± 0.3 gal/min (56.3 ± 1.3   ) min) or more

#### Servicing Entretien

		Reference values for new vehicle Valeurs de reférence pour vehicule neuf	Service limit values Valeurs limite de service	Remarks <i>Remarques</i>
Gear track wear Usure de voie de pignon	Clearance Jeu	0.02 in 0.05 mm	0.066 in 0.15 mm	Up to +0.1 mm (+0.004 in) Jusqu' à +0,1 mm
Gear track wear Usure de voie de pignon	Scratch by gear teeth Rayure par dent de pignon	1/3	1/2	Circumferential Circonférentiel
Shaft/bushing wear Usure d'arbre/manchon	Clearance Jeu	0.004 in 0.1 mm >	0.008 in 0.2 mm	
Bushing wear (left and right) Usure de manchon (gauche et droit)	Length Longueur		0.005 in 0.12 mm	

#### 2. Control valve Soupape de commande

 Specifications Caractéristiques

	Variety <i>Variéte</i>		R510 (B)
	Maker Fabricant	Kayaba	
	Type Type	KVS-65	
	Capacity Capacité	17.2 gal∕min 65 g∕min	
Control valve Soupape de contróle	Max. durable high pressure Pression max.	4480 psi 315 kgf/cm²	
	Max. durable back pressure Pression de retour durable maximum		215 psi 15 kgf/cm <sup>2</sup>
	Parts No. Pièce No.	KBT J.D.	68811-6911-4 68817-6911-2

psi (kgf/cm²)

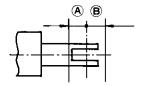
Relief pressure	R510	R510 (B)		
Pression de décompre	Pression de décompression			
Main relief pressure	2490 <sup>+40</sup>	2775 ± 70		
Pression de décompression principale	(175 <sup>+3</sup> )	(195±5)		
	Boom	2775 ± 40	3270 ± 140	
	Flèche	(195 ± 3)	(230 ± 10)	
Overload relief valve	Swing	1920 ± 40	2275 ± 140	
Pression de décompression de surcharge	Rotation	(135 ± 3)	(160 ± 10)	
	Arm	3060 ± 40	3555 ± 140	
	Bras	(215 ± 3)	(250 ± 10)	

<Note> (A) : Bench set pressure Pression au banc d'essai

(B) : Actual machine port pressure

Pression réelle valve sur la machine.

• Control spool stroke & return spring force Course de tiroir de commande et force de ressort de rappel



·		Control spool stroke  Course de tiroir de commande		Return sp Force de r	ring force essort de rappel
·		<b>A</b>	₿	Neutral Point mort	Full stroke Course totale
Lock cylinder Valve section	R510 (B)	0.28 in (7.2 mm)	0.28 in (7.2 mm)	13.2 ~ 35.3 lbw (6 ~ 16 kgf)	
Other valve section	R510 (B)	0.28 in (7.2 mm)	0.28 in (7.2 mm)	18.1 lbw (8.2 kgf)	24.7 lbw (11.2 kgf)

# 3. Cylinder

Cylindre

• Specifications Caractéristiques

Unit in Unite mm

Item <i>E1ment</i>	Cylinder Cylindre	Boom <i>Flèche</i>	Arm <i>Bras</i>	Bucket <i>Godet</i>	Outrigger Stabilisateur	Swing Pivotement
R510 (B)	Maker Fabricant	Kayaba	Kayaba	Kayaba	Kayaba	Kayaba
	Туре <i>Туре</i>	80-40-456	75-40-425	70-40-356	50-30-505	100-95-63×2
	Cylinder inside dia. Dia. intérieur de cylindre	3.14 80	2.95 75	2.75 70	1.96 50	3.94 100
-	Piston rod out side dia. Dia. extérieur de tige de piston	1.57 40	1.57 40	1.57 40	1.18 30	3.74 95
	Stroke Course	17.95 456	16.73 420	14.01 356	19.88 505	4.96 126
	Max. retraction length  Longueur de contraction max.	30.86 784	27.99 774	25.23 641	28.74 730	
	Bushing inside dia. (at rod) Dia. Intérieur de manchon (à la tige)	1.57 40	1.57 40	1.57 40	1.18 30	_
	Bushing inside dia. (at bottom) Dia. Intérieur de manchon (au bas)	1.57 40	1.57 40	1.57 40	1.18 30	_
	Part No. Pièce No.	68879-6751-0	68879-6761-0	68879-6781-0	68869-6721-0	68811-6741-0
	Assy seal Parts No.  Ensemble de joint piece No.				68811-9338-0	68811-9304-0

# Natural fall amount Montant de chute par gravité

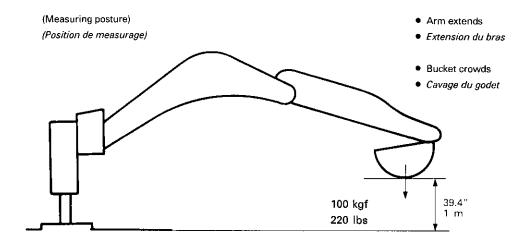
#### Measurement procedure

- 1. Use standard front and standard bucket.
- 2. Purge air form each cylinder.
- 3. Measure falling distance for 10 min.
- 4. Oil temperature must be 113±41°F.

#### Méthode de mesurage

- 1. Utiliser un équipement interchangeable standard et une godet standard.
- 2. Purger l'air de chaque vérin.
- 3. Mesurer la distance de chute pendant 10 minutes.
- 4. La température de l'huile doit être de 45±5°C.

	Unit <i>Unité</i>		Reference value for new vehicles Valeurs de référence pour véhicule neuf	Service limit values Valeurs de limite de service	Remarks Remarques
			R510 (B)	R510 (B)	
Cylinder natural fall Chute par gravité de cylindre	in/min mm/min	Boom Flèche	0.8 20	3.9 100	R510 (B): Bucket with 220 lbs weight Benne avec 100 kgf contrepoids
	in/min mm/min	Arm <i>Bras</i>	0.8 20	3.9 100	
	in/min mm/min	Bucket Godet	0.4 10	2.0 50	
	in/min mm/min	Outrigger <i>Balancier</i>	0.8 20	3.9 100	With machine body being lifted Avec corps de manchon levee
Piston rod deformation Déformation de tige de piston	in mm		0.002> 0,05>	0.02 0,5	
Rod/bushing wear Usure de tige/manchon	in <i>mm</i>	Clearance Dèversement	0.01> 0,25>	0.016 0,4	
Tube/piston ring wear Usure de segment de piston/tube	in <i>mm</i>		0.002 ~ 0.0011 0,05 ~ 0,03	0.024 0,6	



# Operating speed Vitesse de fonctionnement

unit: second unité: seconde

ltem <i>Elément</i>		Reference values for new vehicle Service limit values  Valeurs de référence pour vehicle neuf Valeurs limite de service		Remarks Remarques	
		R510 (B)	R510 (B)		
Boom	upper superieur	1.5 ~ 2.1	2.52	Highest above ground level Le plus haut au-dessus du niveau du sol	
Flèche	lower inférieure	1.7 ~ 2.3	2.76		
Arm	extend étendre	1.8 ~ 2.4	2.88		
Bras	crowd cavage	2.7 ~ 3.3	3.96		
Bucket	dump <i>déverser</i>	1.0 ~ 1.6	1.96		
Godet	crowd cavage	1.7 ~ 2.3	2.76		
Swing	left gauche	1.4 ~ 2.0	2.4	Leftward from center Vers lá gauche à partir du centre	
Bascule	right <i>droit</i>	1.4 ~ 2.0	2.4	Rightward from center Vers la droite à partir du centre	
Outrigger Stabilisateur	extend 1.8 ~ 2.4		2.88	Simultaneous motion left and right Mouvements gauche et droit simultanes	
	shrink <i>Rétrécir</i>	1.1 ~ 1.7	2.04	Simultaneous motion left and right Mouvements gauche et droit simultanes	

(Note) Normal Operating engine speed should be set at 1600 rpm. (Nota) La vitesse normal de fonctionnement du moteur doint être ajustée à 1600 tr/min

# Lever stroke and operating force Course du levier et force de fonctionnement

ltem <i>Elément</i>	Operating force (lb) Force de fonctionnement (kgf)	Stroke (in) Course (mm)	
	R510 (B)	R510 (B)	
Bucket lever Levier de la godet	3.75±0.88 1.7±0.4	2.36±0.79 60±20	
Arm lever Levier du bras	<u> </u>	<u>†</u>	
Boom lever Levier de la flèche	<u> </u>	†	
Swing lever Levier de la bascule	<b>†</b>	<u> </u>	
Outrigger lever Levier de la balancier	3.97±0.88 1.8±0.4	1.97±0.79 50±20	
Safety lock lever Levier de verrouillage de sécurité	7.05±3.09 3.2±1.4		
Hydraulic slide lock lever Levier de commande hydraulique	3.97~10.14±2.20 1.8~4.6±1.0	1.18±0.39 30±10	

### e. Bucket, Boom, Arm Data Données sur le godet, la flèche et le beas depelle

1. Bucket data

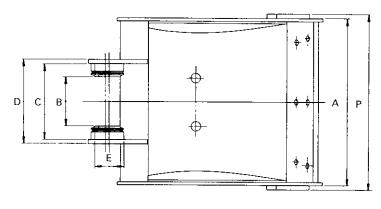
Données sur le godet de pelle

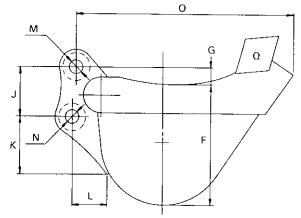
Code No. No de code	Width Largeur	Capacity Capacité					Applicable model	
		Struck Arasement	C.E.C.E. headped Mise en tas C.E.C.E.	SAE heaped Mise en tas SAE	Weight <i>Poids</i>	No. of teeth Nombre de dents	Modéle utilization	Application <i>Utilisation</i>
68741- 66815	14,17 in. 360 mm	0.052 yd³ 0.04 m³	0.06 yd³ 0.045 m³	0.065 yd <sup>3</sup> 0.05 m <sup>3</sup>	99.2 lbs 45 kg	3	R410 (B) KH-60 R510 (B)	Narrow ditch digging Excavation de tranchées étroites
68741- 66802	17.72 in 450 mm	0.065 yd <sup>3</sup> 0.05 m <sup>3</sup>	0.08 yd³ 0.058 m³	0.09 yd³ 0.07 m³	110.2 lbs 50 kg	3	R410 (B) KH-60 R510 (B)	Standard bucket Godet de pelle standard
			0.000		oo ng		11310 (b)	Codet de pene standard

Standard bucket dimension: in (mm) Dimensions standard de benne: mm

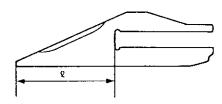
_			
	R510 (B)	, The second second	R510 (B)
Α	17.72 (450)	J	5.20 (132)
В	5.28 (134)	Κ	6.10 (155)
С	8.03 (204)	L	4.13 (105)
D	8.98 (228)	М	1.38 (35)
E	3.15 (80)	N	1.38 (35)
F	13.46 (342)	0	22.99 (584)
G	1.02 (26)	Р	18.66 (474)

- All buckets have same contour of side plate but different width only.
- \* Item Q is heat treated.
- Tous les godet de pelle ont la même configuration de plaque transversale; Seul la largeur diffère.
- \* L'article entouréd'un cercle Q a été traité thermiquement.



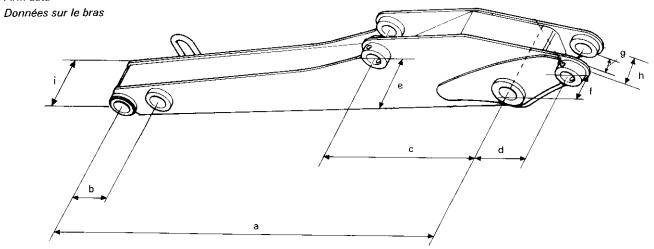


Bucket tooth (code No.: 68131-6691-0)
 Dents de godet



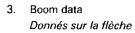
Reference value ( $\mathfrak L$ ) ..... 4.1 in (105 mm) Norme de référence Allowable limit ( $\mathfrak L$ ) ..... 3.1 in (80 mm) Limite antorisée

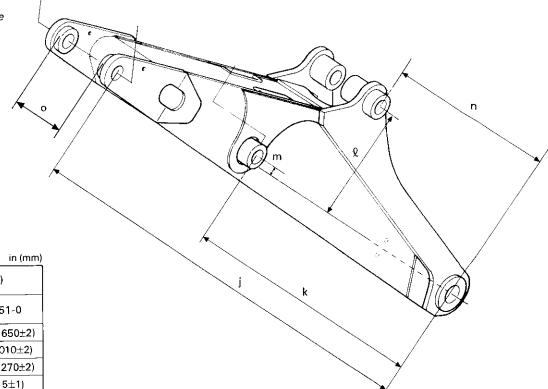
#### 2. Arm data



in (mm)

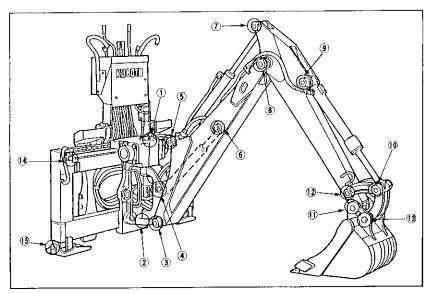
	m (mm)	
Model <i>Modéle</i>	R510 (B)	
Code No.	68817-6660-0	
а	48.03±0.12 (1220±3)	
b	4.92±0.02 (125±0.5)	
С	12.05±0.04 (306±1)	
d	8.98±0.04 (228±1)	
е	6.30±0.04 (160±1)	
f	2.83±0.04 (72±1)	
g	2.01±0.04 (51±1)	
h	3.54 (90)	
i	5.28 (134)	





Model <i>Modéle</i>	R510 (B)
Code No.	68817-6651-0
j	64.96±0.08 (1650±2)
k	39.76±0.08 (1010±2)
R	10.63±0.08 (270±2)
m	0.59±0.04 (15±1)
n	27.56±0.08 (700±2)
0	5.31 <sup>+0.04</sup> (135 <sup>+1</sup> )

## f. Pin and bushing dimensions Dimensions des goupilles et des manchons



Unit: in Unité: mm

ltem	Reference pin dimensions Dimensions de référence desgoupilles	Reference bushing dimensions  Dimensions de référence des manchous
	Pin diameter × Length (in)  Diamète d'axe × Longueur (mm)	Inside diameter × Length (in)  Diamètre intérieur × Longueur (mm)
Model / Modéle	R510 (B)	R510 (B)
1	Pinion, <i>Pignon</i>	2.17 × 1.57 (55 × 40) 2.17 × 3.84 (55 × 97.5)
2	2.17 × 5.67 (55 × 144)	2.17 × 2.36 (55 × 60)
3	1.57 × 6.73 (40 × 171)	1.57 × 2.36 (40 × 60)
4	1.77 × 9.65 (45 × 245)	Boom sylinder Cylinder de fléche
<b>(5</b> )	1.57 × 9.65 (40 × 245)	Arm cylinder Cylinder de bras
6	1.57 × 8.70 (40 × 221)	Boom cylinder Cylinder de fléche
7	1.57 × 6.02 (40 × 153)	Arm cylinder Cylinder de bras
8	1.57 × 9.33 (40 × 237)	1.57 × 1.57 (40 × 40)
9	1.57 × 6.02 (40 × 153)	Bucket cylinder Cylinder de godet
(1)	1.57 × 8.39 (40 × 213)	1.57 × 1.26 (40 × 32)
0)	1.38 × 9.61 (35 × 244)	1.38 × 1.38 (35 × 35)
(2)	1.38 × 8.19 (35 × 208)	1.38 × 1.38 (35 × 35)
(13)	1.38 × 9.61 (35 × 244)	1.38 × 1.38 (35 × 35)
(1)	1.18 × 6.38 (30 × 162)	Outrigger cylinder Cylinder de balancéer
(15)	1.18 × 7.87 (30 × 200)	Outrigger cylinder Cylinder de balancéer
Service limit Limite de service	Up to -0.039 in of pin diameter  Jusque' à -1,0 mm de diamètre de goupille	Up to +0.039 in of inside diameter Jusque' à +1,0 mm de diamètre intérieur

## g. Weight table Tableau des poids

Description	R51	0 (B)
Description	(kgf)	(lbs)
Backhoe (whole) Rétrocaueuse (total)	750	1653
Slide frame Cadre coulissant	166	366
Slide bracket Support coulissant	87	192
Boom Fléche	81	179
Arm Bras	50	110
Bucket STD.  Godet	55	121
Outrigger Stabilisateur	9.5	20.9
Stand (With valve and pipings)  Bequille (avec distributeur et tube)	67	148
Boom cylinder Cylindre de flèche	21	46
Arm cylinder Cylindre de bras	21	46
Bucket cylinder Cylindre de godet	18	40
Bucket linkage 1/2, 3 Maillon de godet	6.5/6.2	14.3/13.7
Swing cylinder Cylindre d'orientation	32	71
Counter weight Contrepoids	300	660

Note: The machine weight is approximate. It slightly varies from version to version.

Note: Le poids de la machine est approximatif. Il varie légrèrement de version en version.

# h. Hydraulic circuit diagram Schéma du circuit hyduelique RS10 Kubota (ISO) patem Caracteristiques Kubota (ISO)

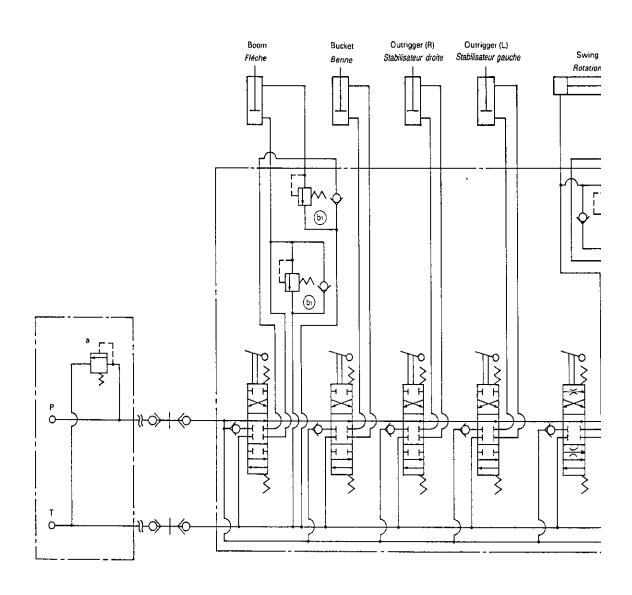
psi (kgf/cm²)	ure Actual pressure	3) 2775±140 (195±10)	-3} 3270±140 (230±10)	:3) 2275±140 (160±10)	(2) SERE+140 (250±10)
	Bench test pressure Pression d'essei au bane	2490-30(175-2)	2490±40 (195±3)	1920±40 (135±3)	3060+40 (215+3)
		ro .	10	3	Ъ3

<Flow rate> 1,40 in²/rev (22,9 cg/rev) 15,7 gal/min (59,5 l/min)

Side lock Verrou couffissent		
PA PA PA PA PA PA PA PA PA PA PA PA PA P	(a) £	
Swing	(a) £	
Outrigue (L)		
Ourrigger (R) Slabilisateur droite		
Bucket Geme	\$ a \$ a	
Boom Helete		

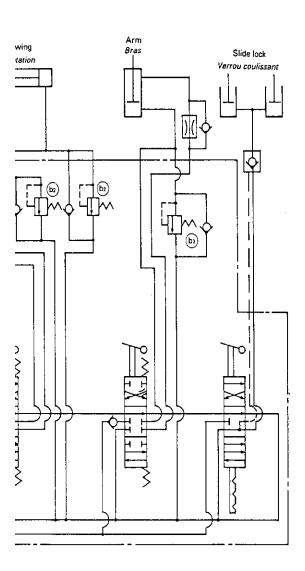
# h. Hydraulic circuit diagram Schéma du circuit hyduelique

R510 Kubota (ISO) pattern Caractéristiques Kubota (ISO)



psi (kgf/cm²)

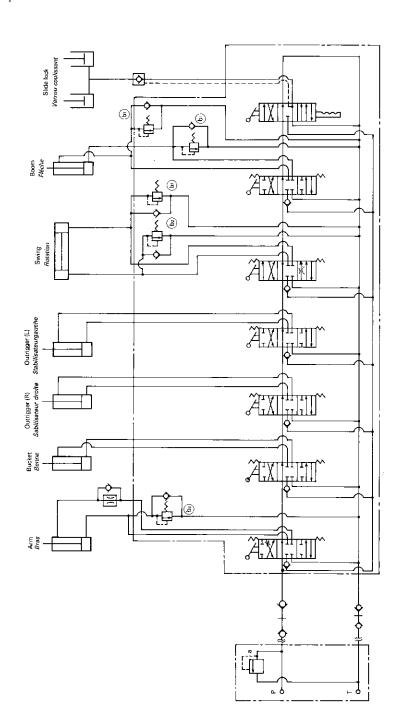
	Bench test pressure Pression d'essai au bane	Actual pressure Pression effective		
а	2490 <sup>+40</sup> <sub>-30</sub> (175 <sup>+3</sup> <sub>-2</sub> )	2775±140 (195±10)		
b1	2490±40 (195±3)	3270±140 (230±10)		
b2	1920±40 (135±3)	2275±140 (160±10)		
b3	3060±40 (215±3)	3555±140 (250±10)		



<Flow rate>

- 1,40 in<sup>2</sup>/rev (22,9 cc/rev)
- 15,7 gal/min (59,5 \( \ext{/min} \)

R510 (B) John Deere Pattern Caractéristiques John Deere



psi (kgf/cm²)

Bench lest pressure

Pression d'essei au bane

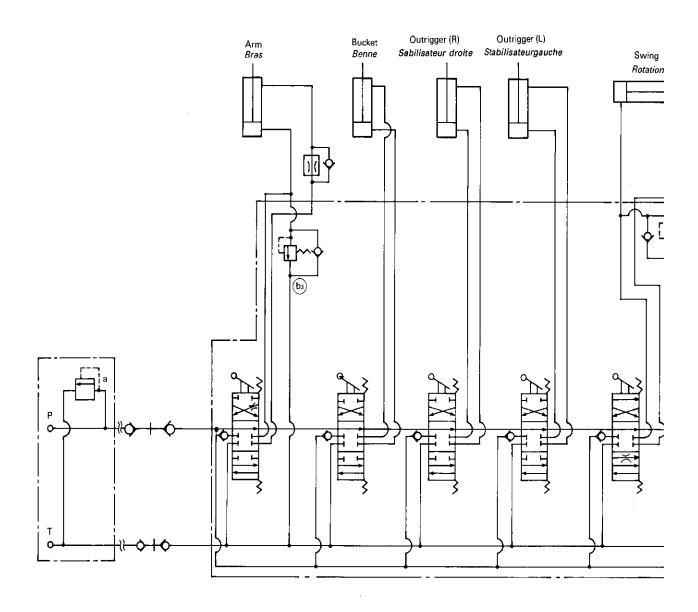
a 2490-40 (115£-2) 2775±140 (198±10)

b2 1920±40 (118£-3) 2275±140 (160±10)

b3 3060±40 (215±3) 3555±140 (250±10)

b3 3060±40 (215±3) 3555±140 (250±10)

<Flow rate>
1,40 in²/rev (22,9 cc/rev)
15,7 gal/min (59,5 1/min)



#### psi (kgf/cm²)

	Bench test pressure Pression d'essaí au bane	Actual pressure Pression effective
а	2490 <sup>+40</sup> <sub>-30</sub> (175 <sup>+3</sup> <sub>-2</sub> )	2775±140 (195±10)
b1	2775±40 (195±3)	3270±140 (230±10)
b2	1920±40 (135±3)	2275±140 ( 160±10)
b3	3060±40 (215±3)	3555±140 (250±10)

<Flow rate>

1,40 in<sup>2</sup>/rev (22,9 cc/rev)

15,7 gal/min (59,5 l /min)

ving Pation	Boom Fléche	Stide lock Verrou coulissant
(b)	~ [ ]	

## **B. Troubleshooting**

## a. Hydraulic Circuit

Symptom	Cause	Remedy	Ref. page
All functions inoperative (front end loader is okay)	Quick-connector disconnected	Reconnect	VII-02
2. All machine functions,	Insufficient hydraulic oil	Replenish	
including front end loader, are inoperative.	Defective main relief valve	Replace	VII-22
	Hydraulic pump not supplying oil	Check for damaged pump drive, worn pump, or clogged suction filter	IV-14
3. Hydraulic oil overheats	Continuous operation against relief	Instruct operator to operate properly	
	Hydraulic oil improper grade and viscosity	Use correct oil	I-17
	Relief valve misadjusted	Adjust to specification	VII-28
	Throttle valve in dipperstick circuit malfunctioning	Repair or replace	
	Oil tank level is too low	Supply specified amount of oil	
	Clogged suction line	Clean or replace suction strainer	
4. Individual cylinder circuit weak	Valve spool not moving fully	Adjust linkage	
or inoperative (others okay)	Valve spool sticks (especially when warm)	Check spool to bore clearance, replace section if not within tolerance	
	Port relief valve misadjusted	Adjust or replace	VII- 23
	Piston seal leakage	Replace seal	
	Dust in overload relief valve	Flash the hydraulic line	VII-23
5. Excessive cylinder movement	Piston seal leaking	Replace seal	
	Antivoid valve leaking	Clean or replace	
	Excessive valve spool to bore tolerance	Replace section	
	External hose or fitting leak	Repair	
Valve section fails at drain passage	System pressure in drain passage caused by return side quick disconnect becoming disconnected.	Install kit to reposition quick disconnect. See Service Bulletin.	VII-15
7. Slide frame hoses damaged	Interference between slide frame and bracket; slide bracket and swing bracket	Miss assem bly	
8. Slide lock malfunction; won't	Check valve leaking or seized	Clean, repair or replace	
lock or unlock, or cylinder leaks	Cylinders leaking	Rebuild	
9. Swing speed is too slow.	Engine r.p.m. is too low, or fast	Adjust engine r.p.m.	

## b. Mechanical Structure

Symptom	Cause	Remedy	Ref. page
Backhoe won't slide easily	Lock mechanism not releasing	Check position of lock valve. Inspect lock check valve	
	Dirt build-up on slide frame	Clean and grease slide rail	
2. Slide bracket loose	Slide rails worn	Replace rails	
3. Backhoe won't fit properly	Excessive welding in backhoe frame	Grind corners of attaching hooks	
Swing angle is unequal to left and right.	Rack and pinion improperly aligned	Disassemble and align marks on rack and pinion	
Excessive operating force of safety lock lever.	Miss fabrication of spring hook pin.	Tap the spring hook pin so that lever operating force is normal.	VII-24
Abnormal noise at pin & bushing.	Lack of grease lubrication.	Apply grease.	

#### C. Testing & Adjustment

#### a. Operating speed

#### (Point)

- Meausre time required for a full stroke with a standard front attachment and no load.
- Take several measurements and base evaluation on the average value.
- When two measurements are inherent, such as swing (right and left), take both measurements and do not average them.
- 4. Assure safety around the machine during inspection.

#### (Conditions)

- 1. Measure speeds at maximum engine rpm.
- 2. Temperature of hydraulic oil: 113 ± 41°F
- 3. Test on the flat ground.
- Take measurements after repeating respective operations at no load several times.

#### 1. Boom cylinder (Above the ground-max)

- 1. Retract the arm cylinder and the bucket cylinder all the way.
- 2. Ground the bucket as shown in the photo.
- 3. Run the engine at maximum rpm.
- 4. Measure the time required for the boom to move from the ground to the cylinder end.

8.7		R510 (B)	
Model	A	В	
Lifting	1.5 ~ 2.1	2.52	
Lowering	1.7 ~ 2.3	2.76	



B: Allowable limit, Limite autorisée

#### 2. Arm cylinder (Full stroke)

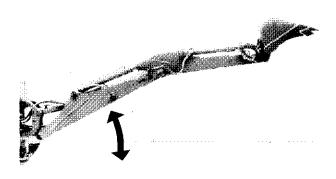
- 1. Position the boom and bucket as shown in the photo.
- 2. Measure the time required for the arm cylinder to move for a full stroke.

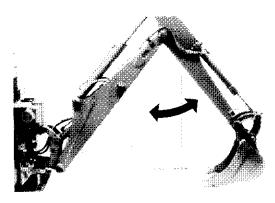
No. of of	R510 (B)	
Model	Α	В
Crowding	1.8 ~ 2.4	2.88
Dumping	2.7 ~ 3.3	3.96

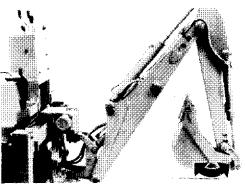
#### 3. Bucket cylinder (Full stroke)

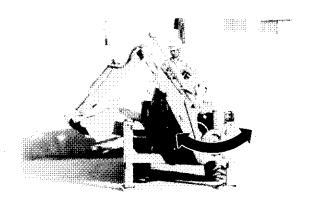
- 1. Position the boom and arm as shown in the photo.
- 2. Measure the time required for the bucket cylinder to move for a full stroke.

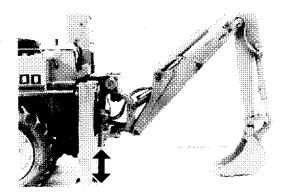
	R510	(B)
Model	А	В
Crowding	1.7 ~ 2.3	2.76
Dumping	1.1 ~ 1.6	1.96











#### 4. Swing cylinder (Full stroke)

- 1. Position the boom, arm and bucket as shown in the photo (bucket bottom about 39.3 in above the ground).
- 2. Measure the time required for the swing cylinder to move for a full stroke.

Model	R510 (B)	
	Α	В
Left	1.4 ~ 2.0	2.4
Right	1.4 ~ 2.0	2.4

#### 5. Outrigger cylinder

- 1. Lift up the body by using backhoe attachment.
- 2. Measure the time required for the outrigger cylinder to move for a full stroke.

Madal	R510 (B)	
Model	Α	В
Extend	1.8 ~ 2.4	2.88
Retract	1.1 ~ 1.7	2.04

#### b. Hydraulic cylinders free fall

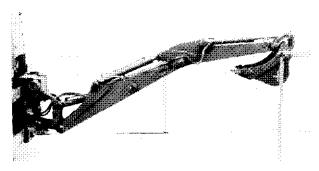
- 1. Place all cylinders in a testing condition and stop the engine.
  - Temperature of hydraulic oil must be 113  $\pm$  41°F (45  $\pm$  5°C)
  - Arm clinder-completely retracted.
  - Bucket cylinder-completely extended and loaded.
     R510 (B): 220 lbs (100 kgf)
  - Boom cylinder-bucket bottom 39.3 in. (10 m) above ground.
- 2. Place a pole beside the bucket and mark both the bucket and the pole.
  - Mark rods of both cylinders with a pencil.
- 3. Measure the distance of fall after 10 minutes.
- If the measurement exceeds the specification, refer to troubleshooting (cylinder circuits) and inspect and repair as required.

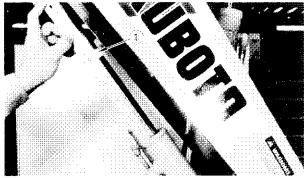


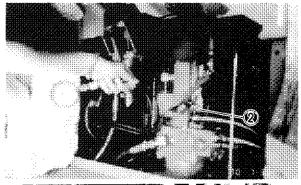


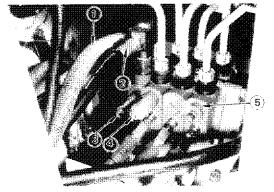
Item		R510	0 (B)
		А	В
Total free fall		2.76	13.78
		70	350
Hydraulic	Boom	0.79>	3.94>
cylinders		20>	100>
	Arm	0.79>	3.94>
		20>	100>
	Bucket	0.39>	1.97>
		10>	50>
Outrig	Outrigger	0.79>	3.94>
		20>	100>
Bucket load		220	blbs
		100	kgf

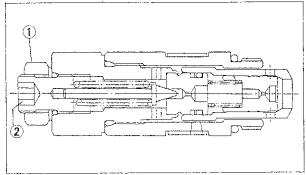
- A: Reference value, Norme de référence
- B: Allowable limit, Limite autorise











#### c. Main relief pressure

#### <Procedure>

- 1. Set the pressure gauge on the main pump as shown in
- Start the engine and check the measurement circuit. 2.
- 3. With the engine running at max rated speed, operate the lever to relieve the cylinder.
  - · Repeat this operation two or three times to achieve an accurate value.
- 4. If the measured value does not comply with the specified value, adjust the pressure (at an oil temperature of 113±41°F, 45±5°C).
  - ① Main pump
    - 2 Pressure port

#### <Specification>

psi kgf/cm<sup>2</sup>

	•
	R510 (B)
Actual port pressure	2775 ± 70 (195 ± 5)
Bench set pressure	2490 -40
	175 -3

- 1 Inlet hose
- 2 Return hose
- (3) Main relief valve
- (4) Overload relief valve for tilt cylinder
- 5 Shut-off valve

#### <Adjustment>

- 1. Loosen the lock nut ①.
- 2. Tighten or return the adjusting screw ② while relieving. Pressure increases or decreases approx. 355 psi (25 kgf/cm²) per every 45 degree.
  - Main relief valve location

#### d. Overload relief pressure

(Main relief pressure over-adjusting method)

#### <Procedure>

- Remove the delivery side adaptor plug and set a pressure gauge.
- Adjust the set pressure at the main relief valves to approximately 0.98 MPa (10kgf/cm², 142.2 psi) higher than the set pressure for the overload relief valve.
- 3. Relieve cylinder at maximum rated engine rpm and read the gauge.
- 4. Repeat this step several times to insure correct readings.
- 5. If the measurement is outside the specification, readjust.
- Reduce the main relief valve set pressure to the specified PSI

#### <Condition>

Oil temp.: 113 ± 41°F (45 ± 5°C)
 Engine: Max. rated 2600 rpm

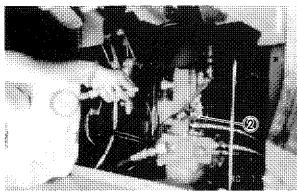
#### <Specification>

psi kgf/cm²

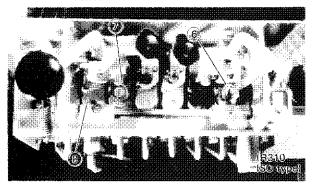
	R510 (B)
Arm bottom side	3555 ± 140 250 ± 10
Boom bottom, rod side	3270 ± 140 230 ± 10
Swing	2275 ± 140 160 ± 10

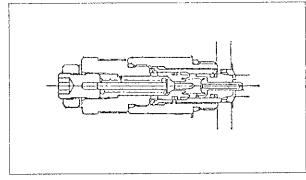
#### <Adjusting>

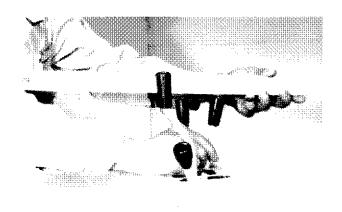
- If the measured value doesn't comply with the specified value, readjust the pressure.
  - Every 30° turn increases or decreases the pressure value of approx. 85  $\sim$  100 psi (6  $\sim$  7 kgf/cm²).
- Be sure to check the pressure value after tightening the lock nut.
  - ① Main pump
  - Pressure gauge port
  - 3 Inlet hose
  - 4 Return hose
- Main relief valve
- 6 Overload relief valve: Boom
- Overload relief valve: Swing
- 8 Arm section

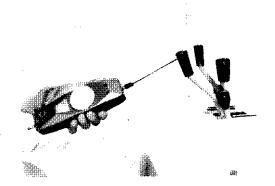


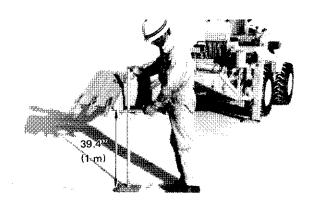












#### e. Control lever play and stroke

- 1. Secure a scale to the side of control lever.
- 2. Measure the play using the scale.

	Stroke	Play
	R510 (B)	R510 (B)
Boom lever	2.36 ± 0.79	
	60 ± 20	
Arm lever	1	
Bucket lever	1	
Swing lever	1	
Outrigger lever	1.97 ± 0.79	
	50 ± 20	
Safety lock lever		
Hydraulic slide	1.18 ± 0.39	
lock lever	30 ± 10	

#### f. Control lever operating force

 Measure the operating force by hooking a spring balancer to the control levers.

	R510 (B)	
Boom lever	$3.75 \pm 0.88  (1.7 \pm 0.4)$	
Arm lever	1	
Bucket lever	<b>↑</b>	
Swing lever	1	
Outrigger lever	3.97 ± 0.88 (1.8 ± 0.4)	
Safety lock lever	7.05 ± 3.09 (3.2 ± 1.4)	
Hydraulic slide lock lever	3.97 ~ 10.14 ± 2.20 (1.8 ~ 4.6 ± 1.0)	

#### g. Bucket sway distance

- Position the boom, arm and bucket as shown in the photo.
- 2. Extend the outrigger until rear tires slightly clear off the ground.
- First pull the bucket with 22.0 lbf (10 kgf) and set the reference pole.
- Push the bucket with 22.0 lbf (10 kgf) and measure the sway distance.

	R510 (B)
Reference value	
Service limit	

## Section VIII

## Structure

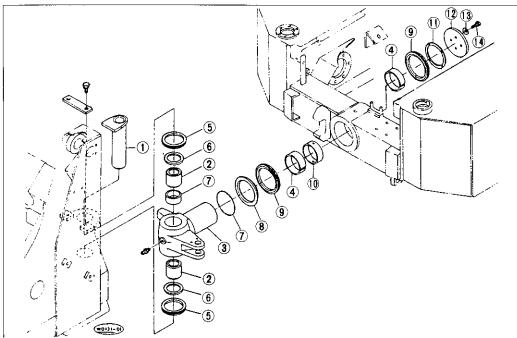
## ---- CONTENTS ----

A.	Sp	ecification	VIII-01
	a.	Center pin & bushing	
В.	Tro	ouble shooting	VIII-02
C.	Tes	sting and Adjustment	VIII-03
	a.	Center pin & bushing	
D.	Se	rvicing	VIII-05
	a.	Center pin & shaft removing	VIII-05
	b.	Hood removing	VIII-09
	c.	Rops/Fops Cab removing & reinstalling	VIII-11

#### A. Specification

## A. Caractéristiques

- a. Center pins and bushing
- a. Goupille centrale et baque



- in. (mm)
- R510 Reference value Allowable limit Valeur de référence Limite admissible  $3.15 \, {-0.002 \atop -0.003} \, (80 \, {-0.05 \atop -0.04})$ Center pin 3.13 (79.5) Goupille centrale Bushing +0.005 +0.003 (80 +0.085 3.15 3.19 (81.0) Bague +0.005 +0.002 (80 +0.15) Front frame hole 3.17 (80.5) 3.15 Orifice de châssis avant +0.001 -0.002 (130<sup>+0.035</sup> -0.05 Center shaft 5.10 (129.5) Arbre central 5.12 <sup>-0.004</sup> (130 <sup>-0.10</sup> <sub>-0.05</sub>) Bushing 5.14 (130.5) Bague
  - End plate mounting bolts Use screw lock-tight.
  - Boulons de montage de plaque de fond Utiliser du Lock-tight pour filets

	R510
Size <i>Taille</i>	M16 x 35 (7T)
Tightening torque Couple de serrage	144.7 ~ 166.4 ft.lbf. (20 ~ 23 kgf.m)

#### b. Rops/Fops canopy & cab.

Mounting bolt tightening torque: M16 × 55 (9T) 191.7  $\sim$  224.2 ft.lbf (26.5  $\sim$  31.0 kgf.m)

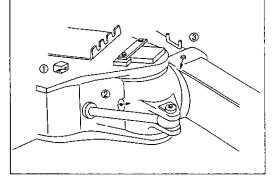
#### b. Capote en toile et cabine Rops/Fogs

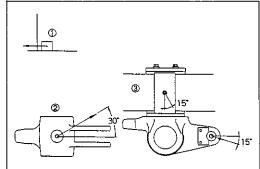
Couple de serrage de boulon de montage  $M16 \times 55$  (97) 191,7  $\sim$  224,2 ft.lbf (26,5  $\sim$  31,0 kgf.m)

- Center pin
   Groupille centrale
- ② Bushing Bague
- 3 Center shaft Arbre centrale
- 4 Bushing Bague
- 5 Dust seal Bague joint
- 6 Thrust collar Rondelle de butée
- O-ring Joint torique
- 8 Thrust collar Rondelle de butée
- 9 Dust seal Bague joint
- ① Collar
- Entretoise

  Thrust collar
- Rondelle de butée

  12) End plate
- 12) End plate
  Plaque de fond
- (13) Plate spring Rondelle belleville
- 14 Bolt Vis





- Steering cylinder bottom side
- 2 Center pin
- 3 Center shaft
- ① Côté base de vérin de direction
- ② Broche centrale
- 3 Axe central

## B. Troubleshooting

	Symptom	Cause	Remedy	Ref. page
1.	Excessive play of pin bushing	Bushing worn Pin worn	Test and inspect the dimension Remove and replace	VIII-03
2.	Abnormal noise when	No lubrication	Apply grease	VIII-05
	articulation.	Pin bushing seizure	Apply grease, remove or replace.	VIII-05
	Oil leaks from hydraulic tank	Looseness of suction filter cover bolt	Tighten bolts	
		Damage gasket	Renew	
	Improper welding	Repair to weld		
		Crack	Repair or replace	
	Cab, canopy Abnormal noise	Looseness of mounting bolts	Tighten to torque	VIII-11, 12
		Some crack	Repair or replace	VIII-11

## B. Dépistage des pannes

Symptôme	Cause	Remède	Page de réf.
Jeu excessif de la bague ou de l-axe	Bague usée Axe usé	Essayer et vérifier la dimension Déposer et remplacer	VIII-03
2. Bruit anormal lors d'une	Pas de lubrification	Appliquer de la graisse	VIII-05
articulation	Bague de l-axe grippée	Appliquer de la graisse, déposer ou remplacer	VIII-05
3. Fuite d'huile du réservoir hydraulique	Boulons de couvercle de filtre d'aspiration desserré	Resserrer les boulons	
	Joint endommagé	Renouveler	
	Soudure incorrecte	Réparer la soudure	
	Craquelure	Réparer ou remplacer	
Bruit anormal de la cabine ou de la capote en toile	Boulons de montage desserrés	Serrer au couple de serrage	VIII-11, 12
	Présence de craquelure	Réparer ou remplacer	VIII-11

## C. Testing and adjustment

#### a. Center pin & bushing play

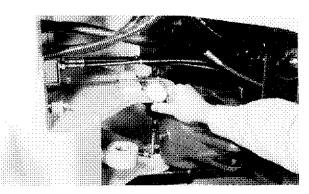
- Measure the outer diameter of the center pin using a micrometer.
  - This is dimension A.
- Measure the inner diameter of the bushing and front frame boss using a dial gauge.
  - This is dimension B.
- 3. B-A is the pin/bushing clearance.

in. (mm)

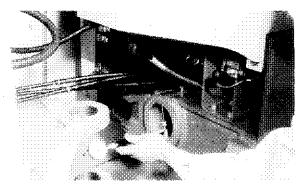
Measuring item	R510
Front frame boss inner dia. limit B1	3.17 (80.5)
Center pin outer dia. limit A:	3.13 (79.5)
Clearance limit B1 – A1	0.04 (1.0)
Center shaft bushing inner dia. limit B2	3.19 (81.0)
Clearance limit B2 - A1	0.06 (1.5)
Rear frame bushing inner dia. limit B3	5.14 (130.5)
Center shaft outer dia. limit A <sub>2</sub>	5.10 (129.5)
Clearance limit B3 - A2	0.04 (1.0)

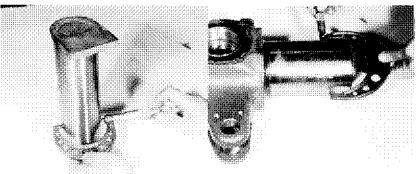


Apply grease after reinstalling.

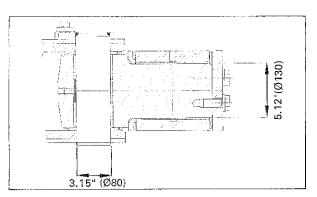








Cross section of center shaft, pin and bushing



## D. Servicing

#### a. Removing center pin & center shaft.

#### Preparation

- Place the machine on the flat floor and ground the shovel bucket horizontally.
- Lower the both backhoe outrigger.
- Remove the front cover, step board and control cable cover.
- Get ready jack or garage jack, oil pan and standard tools.

A

Secure the tire stoppers to prevent moving.

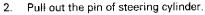
1. Dismount the propellar shaft.

#### (When reassembling)

Bolt tightening torque: 77.5 to 90.2 N.m.

 $M12 \times 25$  (7T) (7.9 to 9.2 kgf.m 57.1 to 41.2 ft.lbf)

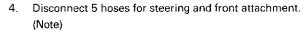
Apply LOCKTIGHT.



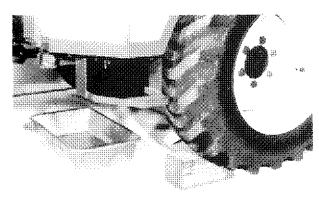
#### (When reassembling)

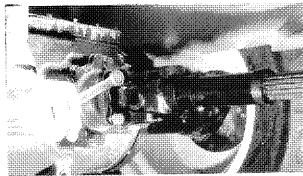
Apply grease to the pin.

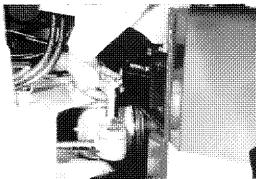
- 3. Start engine and retract the steering cylinder by turning the steering wheel in left direction slowly.
  - (5) Steering cylinder

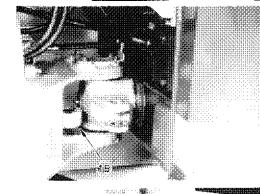


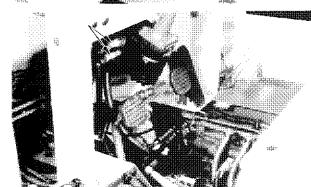
Use the oil pan to catch drain oil.

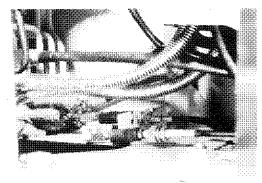


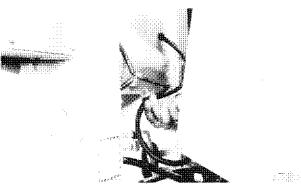


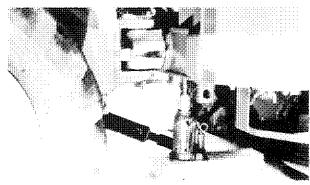


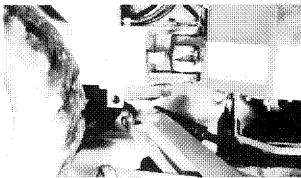


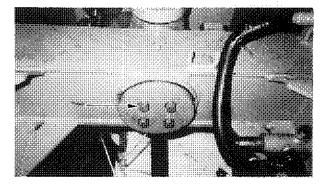










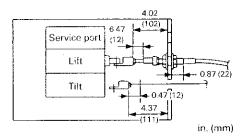


5. Disconnect the control cables.

#### (When reassembling)

Check movement of cables by operating levers after reconnecting them.

• Securely check if operating lever returns to neutral.



Remove the wiring clamp.

7. Use jackes to properly adjust the heights of the rear frame.

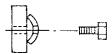
8. Support the front frame with the garage jack.

9. Remove the end-plate ①.

#### (When reassembling)

	R510
Bolt	M16x35,9T
Torque	191.7~224.2 (26.5~31.0)

- Apply Locktight
- Direction of the belleville spring set.



Do not forget to put the dust seal and thrust collar.

10. Carefully move the front frame forward.

#### (When reassembling)

Move it while adjusting the heights by using jack.

Never go into under the frame.

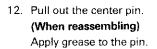
(when reassembling)

Install o-ring, thrust collar and dust seal in order.

Face round chamfer side of thrust collar to O-ring.

8 Thrust collar

- 11. Remove the cover on the center pin.
  - Remove the guide bracket for control cable, too.

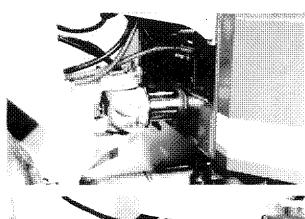


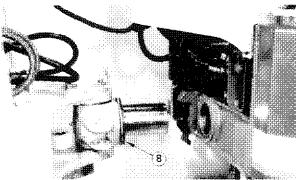
13. Draw the center shaft.

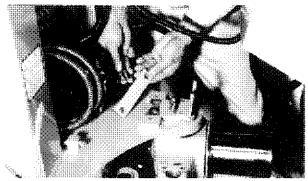
#### (When reassembling)

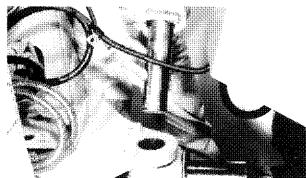
Apply the thrust collars and dust seals onto upper and bottom sides.

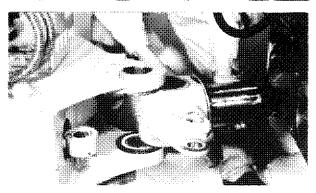
Center shaft weight: 119 ibs (54 kgf)

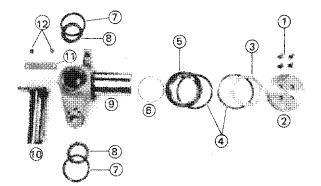


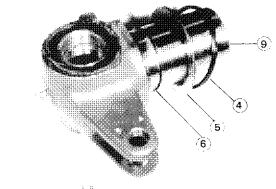


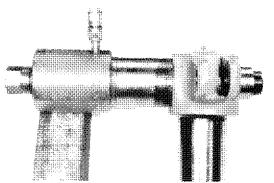


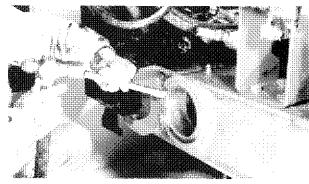


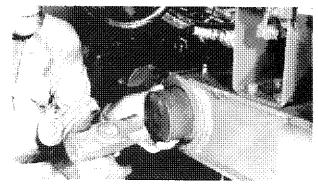












#### <Parts designation>

- ① Bolt
- 2 End plate
- 3 Thrust collar
- 4 Dust seal
- 5 Thrust collar
- 6 O-ring
- 7 Dust seal
- 8 Thrust collar
- 9 Center shaft
- (1) Center pin

#### 14. Center shaft bushing

#### <Bushing wear (I.D.)>

in, (mm)

	R510
Reference value	3.15 +0,005 80 +0.125 +0.003 80 +0.085
Allowable limit	3.19 (81.0)

• Use a press for replacement.

#### 15. Rear frame bushing

• Tap to remove the bushing as shown in left Fig.

#### <Bushing wear (I.D.)>

in. (mm)

	R510
Reference value	5.12 +0.004 130 +0.10 +0.05
Allowable limit	5.14 (130.5)

#### (When reassembling)

Fit evenly by using special tool.

#### b. Hood removing

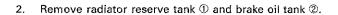
 Remove gas spring installing pin Remove the food cover mounting bolts.

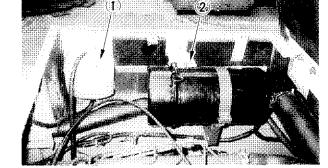
(When reassembling)

Bolt tightening torque: 48.1 to 55.9.ON.m

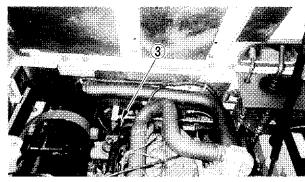
(4.9 to 5.7kgf.m, 35.4 to 41.2ft.lbf)

Hood cover weight 41.2 lbs (18.7kg)



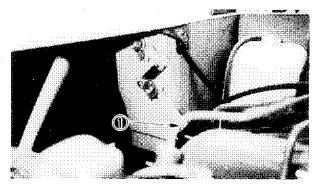


3. Disconnect accelerator shaft and rod 3.



4. Remove the control levers mounting bracket.







Femove the accelerator lever (1).(when reassembling)Check and adjust the lever so that linkage works well.

- 6. Remove the rear cover.
- 7. Loosen the hood mounting bolts to lift it up.



Never place fingers or hand under lifted bonnet.

Hood weight: 91.1 lbs (41.3 kgf)

#### c. Rops/Fops cab removing & reinstalling

#### <Preparation>

- Place a machine on flat floor.
- · Get ready a crane for lifting.
- Get down the front and rear attachment and relieve the residual pressure in the hydraulic circuit.

Rops/Fops weight		R510
Cab	Without B.H.	655 lbs (297 kg)
	With B.H.	683 lbs (310 kg)
Canopy	1	243 lbs (110 kg)

1. Remove the harness in front right side.

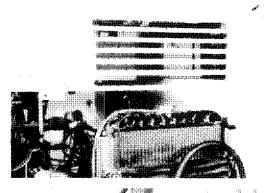


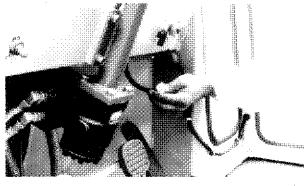
Remove the panel board if necessary.

2. Remove the harness in rear side.

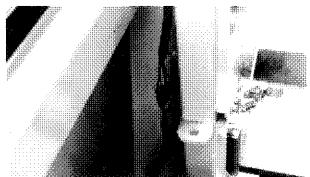
3. Remove cab mounting bolts in front. (when reinstalling)

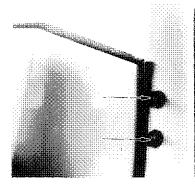
Mounting bolt: M10  $\times$  20 (7T), 4 pcs. Tightening torque: 35.4  $\sim$  41.2 ft.lbf (4.9  $\sim$  5.7 kgf.m)





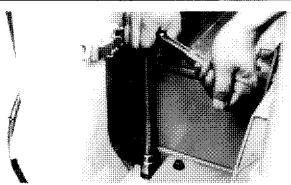


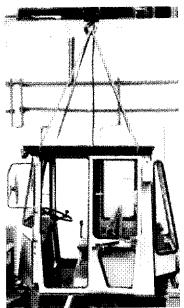












 Remove mounting bolt in side. (When reassembling)

Mounting bolt: M12  $\times$  45 (7T), 2 pcs. Tightening torque: 57.1  $\sim$  66.5 ft.lbf (7.9  $\sim$  9.2 kgf.m)

Remove mounting bolt in rear.
 (When reassembling)

Mounting bolt: M16  $\times$  55 (9T), 8 pcs. Tightening torque: 191.7  $\sim$  224.2 ft.lbf (26.5  $\sim$  31.0 kgf.m)

- 4. Lifting up the cab with crane. (when reinstalling)
  - Align the bolt holes and get down slowly.
  - Take care wire harness won't be pinched.

## Section IX

# **Engine**

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## A. Specification Charactéristiques

# a. Engine specification Characteristiques des moteurs

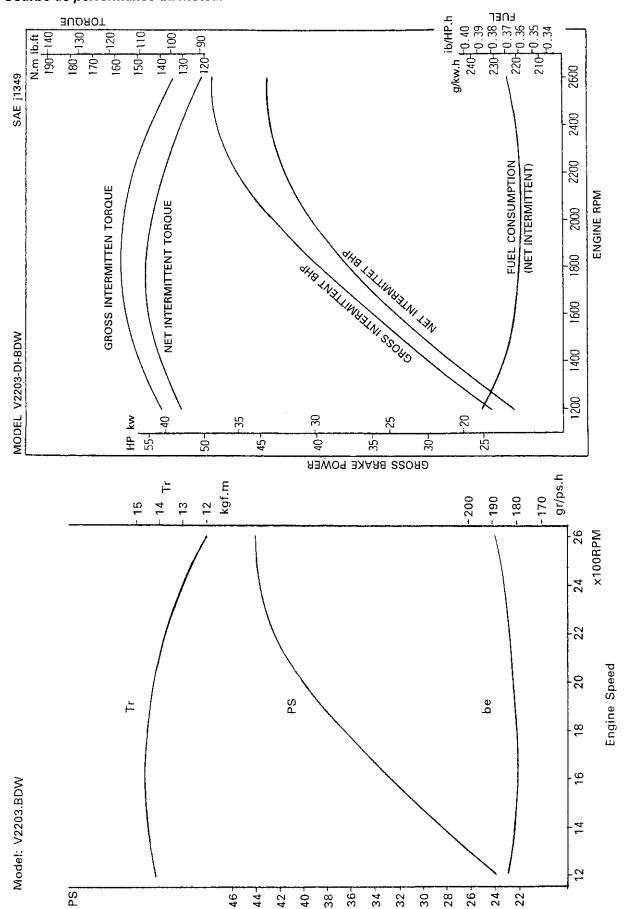
Machine model <i>Modèle de machine</i>	R510	(B)	Remarks Remarques
Engine model Modèle de moteur	V2203-DI-BDW	V2203-BDW	
No. of cylinder No. de cylindres	4	4	
Bore × Stroke [mm] Alésage Œ course [in.]	87 × 92.4 3.43 × 3.64		
Displacement [cc] Déplacement [cu.in.]	2197 134		
Rated output DIN6270NB (JIS D1005) [PS/rpm] Sortie nominale DIN6270NB(JIS D1005) [kW/rpm]	45/2600 33.1/2600		
SAE J1349 Gross         [HP/rpm]           SAE J1349 Globale         [kW/rpm]		/2600 /2600	
Max. torque JIS D1005 Couple max. SAE J1349 ft.lbf (kgf.m)/rpm	110.6	(15.3)	
Torque rise [%]	15%		
Compression ratio Taux de compression	19	22	
Engine dimension (L $\times$ W $\times$ H) [mm] Dimensions du moteur (L $\times$ I $\times$ H) [in.]	659x514x637 25.9x20.2x25.1		Basic model, Modèle principal
Engine weight [kg] Poids du moteur [lbs]	18.63 410	205 451	Dry, Sec
Max. no-load A vide max. [rpm]	2950>	2820>	
One hydraulic pump relief Deux soupapes de pompe hydraulique [rpm]	2600 <sup>+50</sup> -100	2600 <sup>+50</sup> -100	
Low idling Ralenti faible [rpm]	900 ~ 950		
Firing sequence Séquence d'allumage	1-3-	4-2	
Compression pressure A / B [kgf/cm²] Pression de compression A / B [psi]	30 ~ 33/25 427 ~ 469/356	30 ~ 33/23 426.6 ~ 469.3/327	Difference between two cylinder 3 kgf/cm² (43 psi)
Valve clearance [mm] Jeu de soupape [in.]	0.18 - 0.0071 -		
Intake valve timing Synchronisation de la soupape d'admission [degree]	TC - 12°	BC+36°	
Exhaust valve timing Synchronisation de la soupape d'échappement [degree]	BC - 60° TC+12°		
Fuel consumption rate [g/ps.h]  Taux de consommation de carburant [lb/HP.h]	165 0.36	190 0.42	
Hourly fuel consumption amount [1/h]  Quantité horaire de carburant consommé [U.S.gal./h]	5.24 1.38	6.04 1.59	Load ratio = 0.6 Specific gravity = 0.85 Facteur de charge = 0.6 Poids spécifique = 0.85
Engine oil consumption rate Taux de consommation d'huile moteur  [g/ps.h]	1.0>	1.0>	-
Engine oil pressure [kgf/cm²] Pression d'huile moteur [psi]	2.4 ~ 4.5 34.1 ~ 64.0	3.5 ~ 4.5 49.8 ~ 64.0	Rated engine r.p.m Vitesse du moteur nominale
Fuel injection pressure [kgf/cm²]  Pression d'injection en carburant [psi]	228.5 ~ 239 3250 ~ 3400	140 ~ 150 1990 ~ 2136	
Battery charging current  Courant de charge de batterie  [A]	12V × 45A (540W)	12V /45A (540W)	-
Fan belt [mm] Courroie de ventilateur [in.]	9.5 × 940 RPF2370 0.37 × 37.0	REMF6410 MITSUBOSHI	

1 V2203-DI-BDW: S/N 10001 ~

V2203-DI-BDW: S/N 20001 ~

ltems <i>Elèments</i>	V2203-DI-BDW	V2203-BDW	Remarks <i>Remarques</i>
Fuel system) Système de carburant]			
njection-pump type Type de pompe à injection	Bosch mini K type Type Bosch mini K	Bosch mini type Type Bosch mini	
njection-nozzle type Type d'injecteur	Pencil type	DN0PD80	
njection pressure [kgf/cm²] Pression d'injection [psi]	228.5 ~ 239 3250 ~ 3400	140 ~ 150 1990 ~ 2135	
njection timing [degree] Femps d'injection [Degré]	TC -15.5° ~ -17.5°	TC -17° ~ -19°	
Fuel Essence	Diesel light oil Huile légère diesel		
Fuel tank capacity [t̪] Capacité du réservoir à essence [USgal]	6		
Fuel feed pump type Type à pompe d'alimentation en carburant		id pump o d'huile	
Lubricating system] Système de refroidissement]			
Oil unit Unité d'huile		by trochoid pump	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Dil Huile	Kubota genuine oil D	10W-30 or equivalent	
Oil capacity [[)] Capacité d'huile [USgal]	6. 1.5	0	( ) Filter included ( ) Comprend le filtre
Oil pressure [kgf/cm²] Pression d'huile [psi]	2.4 ~ 4.5 34.1 ~ 64.0	3.5 ~ 4.5 49.8 ~ 64.0	Rated rpm Vitesse du moteur nominale
Oil pressure [kgf/cm²] Pression d'huile [psi]	0.5 < 7.1 <	0.5 < 7.1 <	ldle rpm Régime de ralenti
Oil consumption  Taux de consommation d'huile [g/psh]	1.0>	1.0 >	
Cooling system] Système de refroidissement]			
Cooling pump type Type à pompe de refroidissement		gal pump entrifuge	
Radiator capacity [1] Capacité de radiateur [USgal]	7.2 1.90		
Reserve tank capacity [t̪] Capacité du réservoir d'expansion [USgal]	1.0 0.26	1.0 0.26	
Radiator pressure [kgt/cm²] Pression de radiateur [psi]	0.9 12.8	0.9 12.8	
Thermostat type Type de thermostat	Wax pellet Pallette cire		
Electric system] Système électrique]			
Starting motor output Débit du moteur de démarrage	12V – 2.0 kW	12V – 2.0 kW	
Alternator output Débit de l'alternateur	12V × 45A (540W)	12V × 45A (540W)	
Battery (Name, capacity) Batterie (nom, capacité)	12V×56AH (75D31R)	12V × 110AH (105E41R)	
Regulator type Type de régulateur	IC type Type IC	Point contact type Type contacteur de point	<del>, , , , , , , , , , , , , , , , , , , </del>
Glow lamp turn-off time [sec] Durée d'extinction de témoin d'incandescence (sec.)	5>	5>	
Winker on-off [Turn/min] Clignotant marche-arrêt [Tour/min]	60 ~ 120	60 ~ 120	
1 V2203-DI-BDW: S/N 10001 ~	V2203-DI-	BDW: S/N 20001 ~	
• • • • • • • • • • • • • • • • • • • •			

## b. Engine performance curve Courbe de performance du moteur



### c. Maintenance standard Normes d'entretien

Values in column (A) are for new machine. Les valeurs situées dans la colonne (A) s'appliquent à la nouvelle machine.

Values in column (B) are allowable limits. Les valeurs situées dans la colonne (B) représentent les limites autorisées.

Model <i>Modèle</i> Item <i>Pièce</i>		R510 (B)		Remarks Remarques
Model Modèle		V2203-DI-BDW	V2203-BDW	
Cylinder head distortion limit Limite de distorsion de la téte de cylindre		±0.002 ±0.05		Fig.1 per 3.94 in. (100 mm)
Top clearance Jeu supérieur	in mm	0.024 ~ 0.028 0.6 ~ 0.70		Fig.2
Cylinder bore Diamètre intérieur du cylindre	in mm	3.425 ~ 3.426/3.431 87.000~87.022/87.15		Fig.3
Cylinder liner wear limit Limite d'usure de la chemise de cylindre	in mm	0.006 0.15		Fig.3
Min. clearance between cylinder and piston Jeu minimum entre le cylindre et le piston	in mm		0.0026 ~ 0.0042 0.065 ~ 0.107	Fig.4
Clearance with piston ring groove (oil ring) Jeu avec la gorge de segment de piston (bague de graissage)		0.008 ~ 0.0020/0.0059 0.020 ~ 0.052/0.15		Fig.5
Clearance with piston ring groove (compression ring)  Jeu avec la gorge de segment de piston (bague de compression)		0.0037 ~ 0.0047/0.008 0.093 ~ 0.120/0.2		Fig.5
Clearance with piston ring gap (Oil ring) Jeu à la coupe de segment de piston (bague de graissage)	in mm	0.00079 ~ 0.00205/0.0059 0.020 ~ 0.052/0.15		Fig.5
Clearance with piston ring gap (compression ring)  Jeu à la coupe de segment de piston (bague de compression)	ín mm	0.0118 ~ 0.0177/0.049 0.30 ~ 0.45/1.25		Fig.5
Piston O.D. D.E. de piston	in mm		3.3431 ~ 3.3439 84.915 ~ 84.935	
Timing gear backlash Jeu de l'engrenage de distribution	in mm	0.0016 ~ 0.0045/0.0059 0.0415 ~ 0.1154/0.15		Fig.6
Compression pressure Pression de compression	kgf/cm² psi	30 ~ 33/25 427 ~ 469.3/356		(A) / (B)
Valve spring free height Hauteur libre du ressort du soupape	in mm	1.6417 ~ 1.6614/1.6220 41.7 ~ 42.2/41.2		Fig.7 (A) / (B)
Valve spring squareness Quandrature du ressort de soupape	in mm	<0.0394 <1.0		Fig.7

Fig.1 Head distortion and measurement Fig.1 Distorsion de la tête et mesures

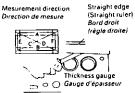
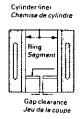


Fig.5 Piston ring gap clearance measurement Fig.5 Mesure du jeu de la coupe de segment de piston



Mesure at position free from wear Mesurer à une position où il n'y a pass d'usure

- Fig.2 Top clearance measurement Fig.2 Mesure du jeu supérieur

Top clearance mesurement Mesure du jeu supérieur

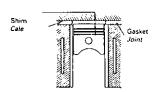
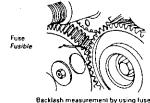
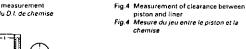


Fig.6 Backlash measurement Fig.6 Mesure du jeu



Backlash measurement by using fuse Mesure du jeu au moyen d'un fusible

Fig.3 Liner I.D. measurement Fig.3 Mesure du D.I. de chemise



Liner

Filler gauge , Pige

. Spring scale

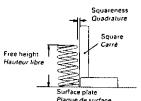
Filler gauge

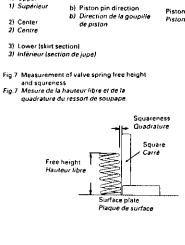
lg Piston



Chemise a) Vertical to piston pin a) Vertical par rapport à la goupille de piston

- 1) Upper 1) Supérieur
- 2) Center 2) Centre

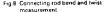






#### Values in column (A) are for new machine. Les valeurs situées dans la colonne (A) s'appliquent à la nouvelle machine.

Model <i>Modèle</i>	Unit <i>Unité</i>	V2203-DI-BDW	V2203-BDW	Remarks <i>Remarques</i>
Connecting rod bend and twist limits Limites de courbure et de torsion de la bielle		0.0020 0.05		Fig.8
Connecting rod large end metal axial play Jeu axial du métal de l'extrémité large de la bielle	in mm	0.0157 ~ 0.0236/0.0315 0.4 ~ 0.6/0.8		Fig.9 (A) / (B)
Connecting rod large end metal oil clearance Jeu d'huile du métal de l'extrémité large de la bielle	in mm	0.0012 ~ 0.0036 0.029 ~ 0.091	0.0014 ~ 0.0037 0.035 ~ 0.093	Fig.9
Crankshaft journal section O.D. D.E. de la section de la portée du vilebrequin	in mm	0.00-100/0.000		Fig.9
Crankshaft journal section O.D. D.E. de la section de la partée du vilebrequin	in mm		0.00465/0.008 - 0.118/0.2	Fig. 9
Crankshaft crank pin O.D. D.E. du maneton du vilebrequin	in mm	1.8488 ~ 1.8494/0.008 46.959 ~ 46.975/0.2		Fig.9
Crankshaft side clearance Jeu latèral de vilebrequin	in mm	0.0028 ~ 0.0087/0.0028 0.07 ~ 0.02/0.07		Fig.9 (A) / (B)
Camshaft cam height Hauteur de came de l'arbre à cames	in mm	(IN)1,30972 ~ 1,30996/1,3079 (33,267 ~ 33,273)/(33,22) (EX)1,31744 ~ 1,31823/1,3157 (33,463 ~ 33,483)/(33,42)	1.3177/1.3157 33.47/33.42	Fig.10 (A) / (B)
Valve face angle Angle de surface du siège de soupape	(°)	IN EX 45°23' ~ 45°37'	IN 60° EX 45°	Fig.12
Valve head standard thickness Epaísseur standard du lit de soupape	in mm	(IN) 0.1043 ~ 0.1201 (2.65 ~ 3.05) (EX) 0.1102 ~ 0.1260 (2.80 ~ 3.20)	0.0335 0.85	Fig.11
Valve stem dia. Diamètre de tige de soupape	in mm	0.3134 ~ 0.3142 7.960 ~ 7.980		Fig.11 (A) / (B)
Allowance for valve fall Tolérance pour la chute de soupape	in mm	0.0256 ~ 0.0335 0.65 ~ 0.85	0.0020 ~ 0.059 0.05 ~ 0.15	Fig.12 (A) / (B)
Valve seat face width Largeur de la surface de siège de soupape	in mm		0.0835 2.12	Fig.12
Clearance between trochoid pump inner surface and outer rotor Jeu entre la surface interne de la pompe trochoide et le rotor extérieur	in mm	0.0039 ~ 0.0063/0.0079 0.10 ~ 0.16/0.0079		Fig.13 (A) / (B)
Clearance between trochoid pump outer rotor and cover Jeu entre le rotor extérieur de la pompe trochoide et le couvercle	in mm	0.105 ~ 0.150		Fig.14 (A) / (B)
Pressure for radiator hydraulic pressure test Pression pour le test de pression hydraulique du radiateur	psi kgf/cm²	12.8 0.9	•	Fig.15
Valve opening pressure of cap Pression d'ouverture de soupape du chapeau	psi kgf/cm²	19.9 1.4	10.7 ~ 14.9 0.75 ~ 1.05	Fig.16
Thermostat starting temperature Température de démarrage du thermostat	°F °C	157 ~ 162.5 69.5 ~ 72.5		Fig.16
Thermostat full lifting distance  Distance d'ouverture du thermostat	in mm	0.315 8	-	Fig. 16 at 185°F (85°)



Thickness

gauge Gauge d'épaisseur

Fig.8 Connecting rod bend and twist measurement
Fig.8 Mesure de la courbure et de la torsion de la biefle

Chamber Chambre Outer rold

Outer rotor Ratar extérieur

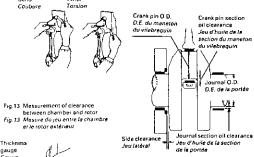


Fig.9 Measurement of connecting rod large and metal and crankshaft journal metal Fig.9 Mesure du métal de l'extrémité large de la bielle et du métal de la portée du vilabrequin

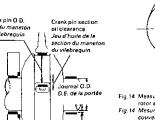


Fig. 14 Measurement of clearance between rotor and cover
Fig. 14 Mesure du jeu entre le rotor et le couvercle

Fig. 10 Camshalt cam height measurement Fig. 10 Mesure de hauteur de came de l'arbre à cames

Rotor Rotor Thickness gauge Gauge d'épaisseur

Measurement position for valve stem squeareness Position de mesure pour la quadrature de la tige de soupape

Valve head thickness Epaisseur de la tête de soupape

Fig. 15 Radiator hydraulic pressure test Fig. 15 Test de pression hydraulique du radiateur

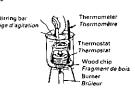


Fig.12 Measurement of allowance for valve

Fig. 12 Mesure de la tolérance pour la chute de soupape



Fig 16 Thermostal inspection Fig.16 Vérification du thermostal





#### d. Tightening torque Couples de serrage

Name of bolt and nut Nom des boulons et écrous		Nominal size × pitch (mm)  Taille nominale × pas (mm)	Tightening torque (ft.lbf, kgf.m)  Couple de serrage (kgf.m)
Cylinder head bolt     Boulon de culasse	(V2203 BDW)	M11 x 1.25	68.7 ~ 72.3, 9.5 ~ 10.0
	(V2203 DI-BDW) ★	M11 × 1.25	68.7 ~ 72.3 , 9.5 ~ 10.0
Cylinder head cover nut (V2203 BDW)     Ecrou de cache-culbuteurs (V2203 DI-BDW)		M8 x 1.25	5.06 ~ 6.51 , 0.70 ~ 0.90
3. Connecting rod bolt 3. Boulon de bielle	(V2203 BDW) ★	M8 × 1.0	26.8 ~ 30.4, 3.7 ~ 4.2 32.5 ~ 36.2, 4.5 ~ 5.0 (Flange)
	(V2203 DI-BDW) ★	M8 × 1.0	26.8 ~ 30.4 , 3.7 ~ 4.2
4. Flywheel bolt (V2203 DI-BDW) 4. Boulon de volant (V2203 DI-BDW)		M12 x 1.25	72.3 ~ 79.6 , 10.0 ~ 11.0
5. Crankshaft nut (V2203 DI-BDW) 5. Ecrou de vilebrequin (V2203 DI-BDW)		M30 x 1.5	101.2 ~ 115.7 , 14.0 ~ 16.0
6. Bearing case bolt 1 6. Boulon de carter de r	oulement 1 *	M9 x 1.25	34 ~ 37.6, 4.7 ~ 5.2
7. Bearing case bolt 2 (V 7. Boulon de carter de r	2203 BDW) oulement 2 (V2203 BDW)	M10 × 1.25	50.6 ~ 54.2 , 7.0 ~ 7.5
Bearinng case bolt 2 (V2203 DI-BDW)  Boulon de carter de roulement 2		M 10x1.25	47.0 ~ 50.6 , 6.5 ~ 7.0
8. Nozzle holder (V2203 BDW) 8. Support de gicleur		M20 × 1.5	36.2 ~ 50.6 , 5.0 ~ 7.0
Nozzle locating screw (V2203-DI-BDW) Support de gicleur (V2203 DI-BDW)		M8 x 1.25	18.1 ~ 21.7, 2.5 ~ 3.0
9. Injection pipe nut (V2203-BDW) 9. Ecrou de tuyau d'injection (V2203-BDW) Injection pipe nut (V2203-DI-BDW) Ecrou de tuyau d'injection (V2203-DI-BDW)		M12 × 1.5	18.1 ~ 25.3 , 2.5 ~ 3.5
		M12 × 1.5	10.8 ~ 18.1 , 1.5 ~ 2.5
10. Glow plug (V2203-BDW) 10. Bougie incandescente (V2203-BDW)		M10×1.25	14.5 ~ 18.1 , 2.0 ~ 2.5
Glow plug (V2203-DI-BDW) Bougie incandescente (V2203-DI-BDW)		M10 x 1.25	10.8 ~ 14.5, 1.5 ~ 2.0
11. Glow plug terminal nut (V2203-DI-BDW) 11. Ecrou de borne de bougie incandescente (V2203-DI-BDV)		M4 × 0.7	0.72 ~ 1.30 , 0.10 ~ 0.18
12. Oil switch (V2203 BDW) 12. Contacteur d'huile (V2203 BDW)		PT 1/8	10.8 ~ 14.5 , 1.5 ~ 2.0
13. Rocker arm bracket stud (V2203-DI-BDW), Nut (V2203-BDW) 13. Ecrou de support de culbuteur (V2203-DI-BDW), Nut (V2203-BDW)		M8 x 1.25	17.4 ~ 20.3, 2.4 ~ 2.8
	nut (V2203 DI-BDW)	M8 × 1.25	17.4 ~ 20.3, 2.4 ~ 2.8
14. Idle gear shaft 1 bolt 14. Boulon d'axe de pign	on ıntermédiaire 1	M8 x 1.25	17.4 ~ 20.3, 2.4 ~ 2.8

2. All other bolts and nuts should be tightened according to its ordinary specifications.

Bolts and nuts, marked ★ should be tightened after applying engine oil on all surfaces.

New head bolt should be installed after cleaning its thread and seat without any oil. When reusing the head bolt, apply engine

Les boulons et écrous marqués de ★ doivent être serrés après avoir appliqué de l'huile moteur sur toutes les surfaces. De nouveaux boulons à tête doivent être installés après le nettoyage des filets et sièges de toute trace d'huile. Lors de la réutilisation de boulon à tête, appliquer de l'huile moteur. Tous les autres boulons et écrous doivent être serrés en accord avec les caractéristiques ordinaires.

## D. Servicing

#### a. Radiator

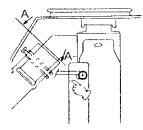
1. Remove the rear cover and drain cooling water.

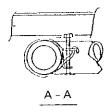
Radiator capacity	Reserve tank capacity
1.90 gal (7.2ᢤ)	0.26 gal (1.0ℓ)

- (1) Drain cock
- 2. Remove the hose clamp mounting bolts and oil cooler.
  - ① Oil cooler
  - ② From LST motor
  - ③ To tank

3. Remove the reserve tank 1).

Remove the top radiator support.
 (when reassembling)
 Install support before installing hood.

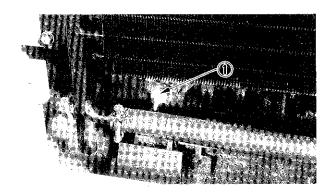


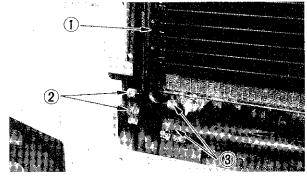


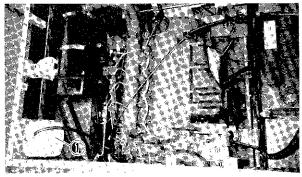
Remove the battery.
 Battery weight; 42.1 ibs (19.1 kgf)

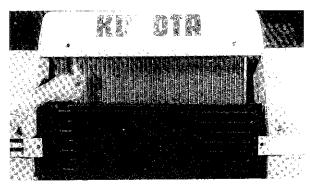


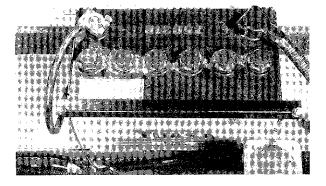
Disconnect (-) terminal first when removing and connect (+) terminal first when reinstalling.

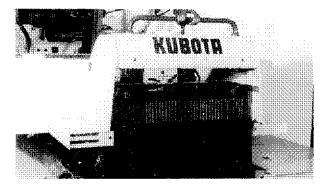


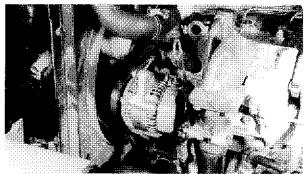


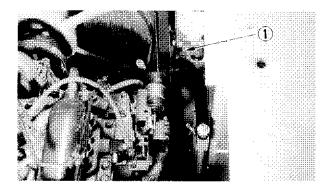


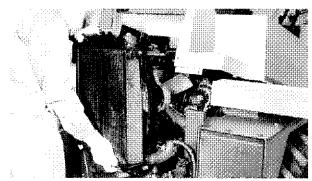


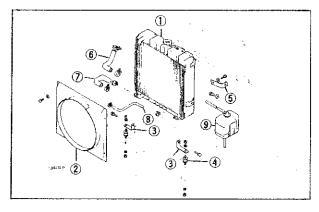




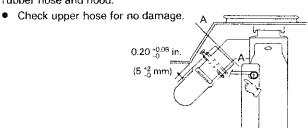








Disconnect the upper and both lower radiator hoses.
 When reinstalling: Maintain 0.2 in (5 mm) gap between rubber hose and hood.



Remove the frame mounting bolts.
 Lift up in the rear frame side to insert the support.

- 8. Loosen the radiator bracket mounting bolts.
  - 1 Radiator bracket

Remove the radiator.
 Take care not to damage radiator core.
 Radiator weight

- 1 Radiator assy
- (2) Fan shroud
- (3) Radiator bracket
- 4 Shock absorber
- ⑤ Radiator Support
- 6 Water pipe, upper
- (7) Water pi[e, lower
- (8) Return pipe
- (9) Reserve tank

#### b. Accelerator

- 1. Remove the accelerator pedal and rod.
  - (1) Accelerator pedal
  - 2 Return spring
  - (3) Rod
  - (4) Rubber tube
  - (5) Fork end

#### (when reassembling)

- 1. Set the stopper bolt to 25.6 in (65 mm).
- 2. Secure the accel rod installing position at engine side.
- 3. Adjust the engine idling speed by turning the fork end.

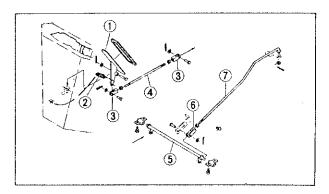
Engine speed: Idling: 850 ~ 950 rpm

Rated: 2600 rpm Max: 2800 rpm

Accelerator pedal:

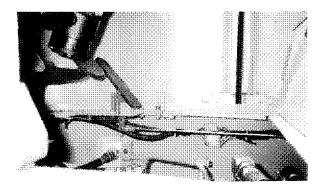
Treading force: 12.2  $\pm$  2.2 lbs (5.5  $\pm$  1kgf) Stroke: 2.31  $\pm$  0.39" (6" $\pm$  10 mm)

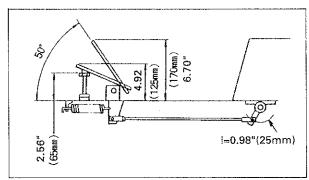
 Adjust the accelerator rod so that arm angle should be approx. 30° when idling rpm.

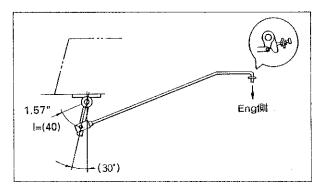


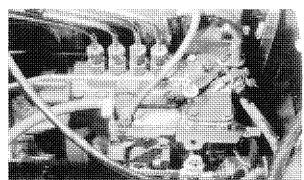
- 2. Key stop solenoid linkage adjusting method
  - Key stop solenoid
  - ② Stop lever 2
  - 3 Stop lever 1
  - 4 Hook pin
  - ⑤ No clearance

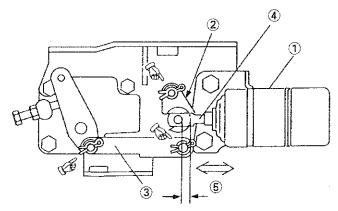
Apply gresse when assembly

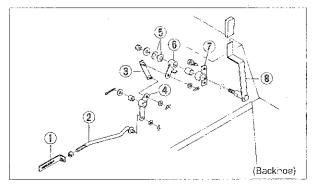


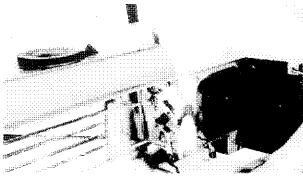


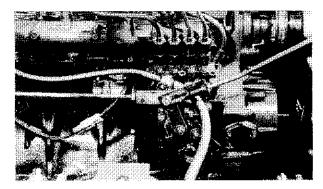


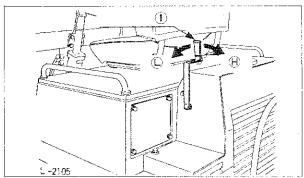












- 2. Remove the accelerator lever of Backhoe.
  - ① Fork end
  - 2 Accel rod
  - 3 Link
  - 4 Lever 2
  - ⑤ Plate spring
  - 6 Lever 1
  - ⑦ Bracket
  - ® Accelerator lever

#### (when reassembling)

- 1. Apply grease on the plate spring (5).
- 2. Adjust the operating force of accelerator lever (8) by tightening or loosening the nut (9).

- Secure the fork end installing hole.
  - (A) : Accelerator pedal rod.
  - B : Accelerator lever rod.



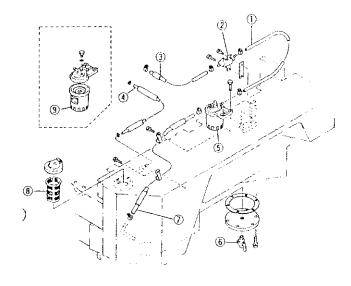
#### Safety

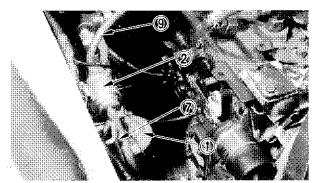
Return the accelerator lever to stop side when in no use.

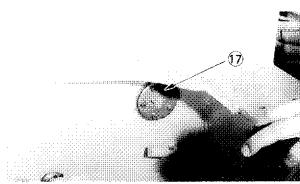
- 1 : Accel lever
- H : Engine speed high
- $\begin{tabular}{l} \end{tabular} \end{tabular}$  : Engine speed low

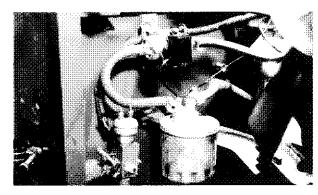
## C. Fuel piping

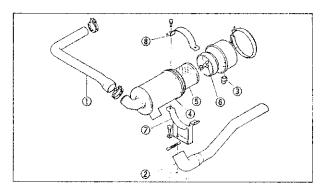
- 1) Fuel filter assy
- 2 Fusl pump assy
- (3) Tank cap
- 4 Inlet screen
- 5 Fuel tube l=35.4" (900mm)
- 6 Protect tube 1|=30.7"(780mm)
  7 Fuel tube |=10.2"(260mm)
- 8 Shock absorver
- 9 Fuel tube l=13.4"(340mm)
- Fuel tube l=30.5"(775mm)
- Protect tube I=27.8"(705mm)
- Packin
- Cover
- Drain cock
- Code clamp
- Filter element
- Fuel sensor

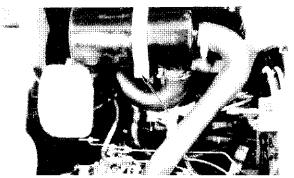


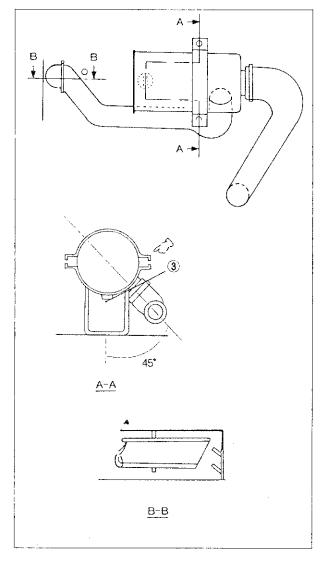












### d. Air cleaner Check & clean: Every 50 hours.

Replace: Every 2000 hours.

- ① Inlet pipe 2
- 2 Inlet pipe 1
- 3 Automatic dust valve
- 4 Air cleaner body
- (5) Air cleaner element assy
- 6 Wing bolt
- Mounting bolt
- (8) Wing nut

Air cleaner mounting bolt:
 Tightening torque: 1.81 ft.lbs (0.5 kgf.m)
 Excess tightening deforms the air cleaner body.

- Install the dust valve ③ in the straight down direction as shown in Fig.
- 3 Automatic dust valve

#### e. Muffler

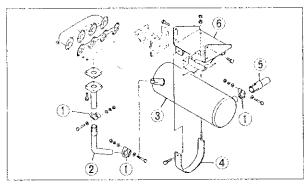


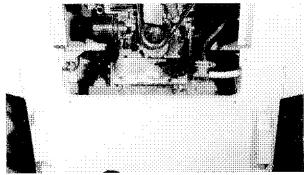
Never touch the muffler or exhaust manifold while engine is hot.

- (i) Pipe band
- 7 Exhaust pipe bracket

Muffler flange

- (2) Muffler pipe 2
- Muffler pipe 2
- 3 Muffler
- 4 Muffler band
- (5) Exhaust pipe
- (6) Muffler bracket
- 1. Loosen the pipe band (i).
- 2. Remove the muffler bracket 6 at engine side and remove muffler assy downward.

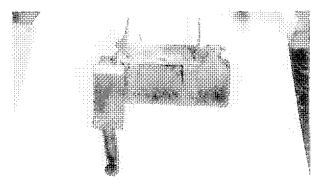




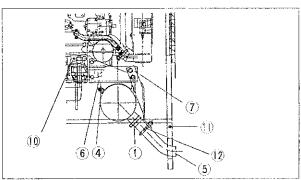
#### (Precautions when reassembling)

- Align muffler connection with muffler pipe 2 2 before installing clamp.
- Place the exhaust pipe in center of rear frame hole.
- Never twist band.

Band tightening torque: 5.06 ft.lbs (0.7 kgf.m)

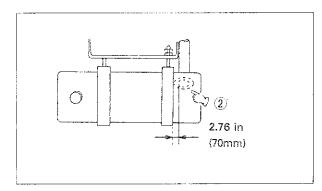


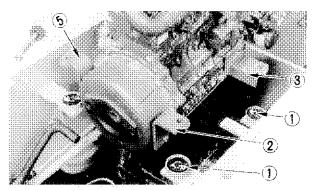
- Engine bracket
- Rear frame
- U bolt

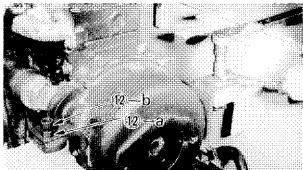




Muffler band should not on the welding bead.

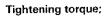






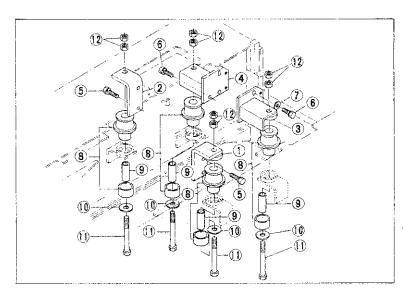
#### f. Engine mount detail

- ① Cushion
- (2) Engine bracket, Front left
- (3) Engine bracket, Rear left
- 4 Engine bracket, Rear right
- 5 Engine bracket, Front right



- Engine bracket, front: 90.4~108.5 ft.lbf (12.5~15.0 kgf.m)
- Tengine bracket, rear: 35.4~41.2 ft.lbf (4.9~5.7 kgf.m)
- (8) Mounting nut: 28.9~33.3 ft.lbf
  - (4.0~4.6 kgf.m)
- (9) Mounting bolt: 17.4~20.3 ft.lbf (2.4~2.8 kgf.m)

APPLY LOCKTIGHT.



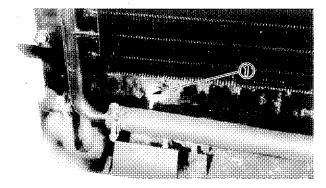
- 1 Engine bracket, Front left
- 2 Engine bracket, Front right
- 3 Engine bracket, Rear left
- 4 Engine bracket, Rear right
- 5 Bolt
- 6 Bolt
- ? Plain washer
- 8 Assy cushion
- 9 Collar
- 10 Plain washer
- ① Bolt
- 12 Nut

#### Tightening torque;

- 12 Nut
  - a First nut: 72.3 ft.lbf (10 kgf.m)
  - b Second nut: 144.6 ft.lbf (20 kgf.m)

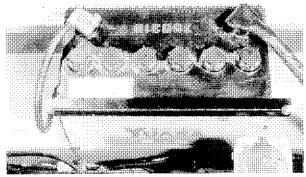
#### g. Engine assy removing

- 1. Remove the rear cover and drain cooling water.
  - ① plug



2. Remove the battery.

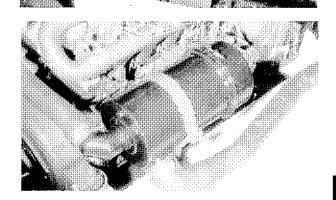
Disconnect — terminal first when removing and connect + terminal first when remounting.

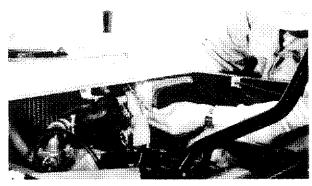


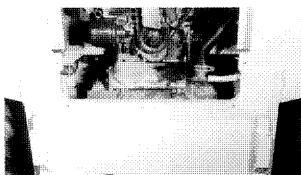
3. Remove the oil cooler.

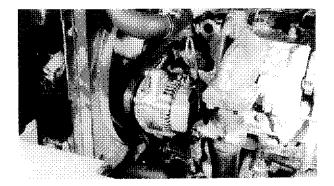


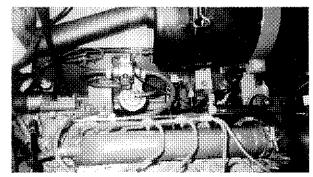
- 4. Remove the air cleaner.
- 5. Remove the reserve tank.

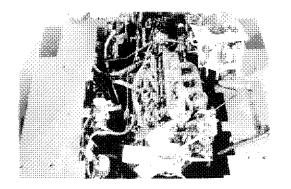








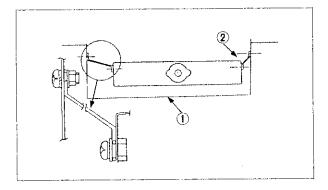




Remove the radiator support at hood side. (when reassembling)

Fix the support at radiator side before installing the hood.

- ① Hood
- ② Support



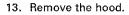
- 7. Remove the muffler assy with the bracket.
- 8. Disconnect three rubber hoses.

- 9. Disconnect fuel hose.
  - 1 Inlet port of injection pump
  - (2) Return pipe

- 10. Remove the wire harness.
  - (1) Starter
  - 2 Alternator
  - 3 Oil switch
  - 4 Water thermometer sensor
  - (5) Key stop solenoid
  - 6 Glow plug
  - 7 Tachometer cable
  - 8 Body earth

11. Remove the operating lever assy.

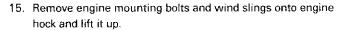
- 12. Remove accelerator rods.
  - (i) Accelerator pedal rod
  - 2 Accelerator lever rod (B.H.)



Hood weight: 91.1ibs (41.3 kgf)

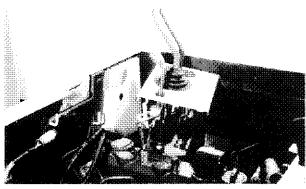


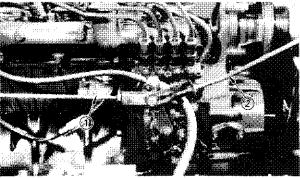
Radiator weight: 27.6 ibs (12.5 kgf)

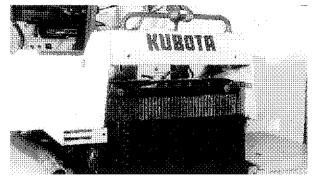


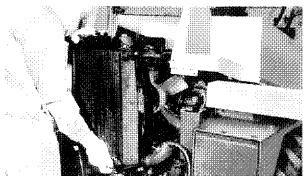
Nut tightening torgue:

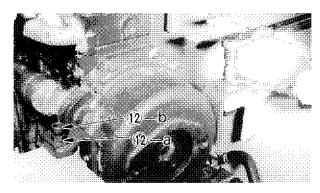
(2) - a First nut: 72.3 igf (10 kgf.m) (2) - b Lock nut: 144.7 igf (20 kgf.m)











#### h. Special precaution

#### Checking radiator hoses (water pipes)

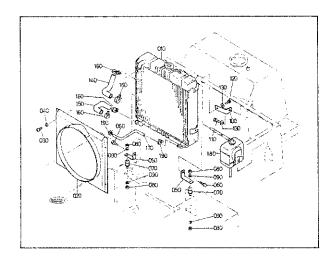
- Check to see if radiator hoses are properly fixed every 200 hours of operation or six months, whichever comes first.
  - (1) If clamp bands are loose or water leaks, tighten bands securely.
  - (2) Replace hoses and tighten clamp bands securely, if radiator hoses are swollen, hardened or cracked.
- Replace hoses and clamp bands every 2 years or earlier if checked and found that hoses are swollen, hardened or cracked.

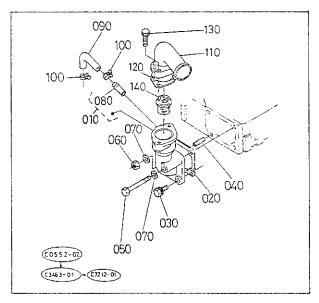
#### Precaution at overheating

Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called "Overheating".

- (1) Stop the machine operation in a safe place and keep the engine unloaded idling.
- (2) Don't stop the engine suddenly, but stop it after about 5 minutes of unloaded idling.
- (3) Keep yourself well away from the machine for further 10 minutes or while the steam blown out.
- (4) Checking that there gets no danger such as burn, get rid of the causes of overheating according to the manual.

And then, start again the engine.





# Section X

# **Electrical**

#### --- CONTENTS

A.	Sp	ecifications	X-01
	a.	Data of electrical units	X-01
	b.	Location of electrical units	X-05
	C.	Comparison of electrical wiring	X-06
	d.	Electrical circuit diagram	X-07
	e.	Wire harness clamp location	X-09
В.	Tre	publeshooting	X-10

## A. Specifications Spécifications

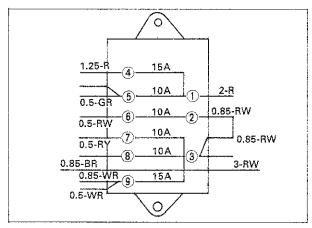
### a. Data of electrical units a. Données des unités électriques

	Machine Model Modèle de machine	R510	(B)
	Item Moteur Elément	V2203-DI-BDW (0 ~ S/N )	V2203-BDW (S/N )
1. Battery <i>Batterie</i>	Capacity Capacité	12V x 56 AH	12V x 100 AH
	Type Type	75D31R	105E41R
	Dimensions (L × W × H) Dimensions (L × W × H)	12.0 × 6.8 305 × 173 >	
	Electrolyte specific gravity (68°F) Gravité spécifique de l'électrolyte (20°C)	1.20	3≦
ter engl	Connection of battery cells  Branchenment des cellules de la batterie	+	1997
	Code No.	68131-5	3411
2. Charging Charge	Type Type	Alternator, A	Alternateur
	Nominal voltage Tension nominale	12V x 45A (5000 rpm)	
	Max. output Rendement Maximum	540W	
	Rotating direction  Direction de rotation	Clockwise, viewed from the pulley side Sans le sens des aiguilles d'une montre, vue du côté la poulie	
	Polarity Polarité	Negative grounding Négative	
	Code No. No. de code	17356-6401-0	
3. Regulator Régulateur	Type Type	Built-in IC type	
·	Regulator regulating voltage Tension de régulation du régulateur	14.2 ~ 14.8 V	
	Relay cut-in voltage Tension du conjoncteur de de relais	_	
4. Starter Starter	Type Type	Reduction type Type à réduction	
	Nominal voltage Tension nominale	12V	
a sold	Nominal output Rendement nominale	2.0 kw	
	Time rating Evaluation du temps	30 sec	onds.
	Rotating direction Direction de rotation	Clockwise, viewed from the pans le sens des aiguilles d'une	
	No. of pinion gear No. des engrenages du pignon	9	
	Code No. No. de code	15425-6	3011

	Engine <i>Moteur</i>	V2203-DI-BDW	V2203-BDW
5. Glow plug Bougie de	Type Type	Sheathed quick glow type Type à gaine	
pre-chauffage	Voltage/current (per glow plug) Tension/courant	Current value at 6 seconds at 10.5 VDC: Approx. 9.0 Valeur du courant aprés 6 secondes à 10.5 VCC: Environ 9.0 A	
	Resistance Résistance	C	0.8Ω
	Code No. No. de code	17331-6551-1	16241-65511
6. Safety relay <i>Relais de sécurité</i>	Code No. No. de code	6881	1-53231
	Rated coil current Courant d'enroulement nominal	0.16	2±0.03A
	Loading current capacity  Capacité de courant de charge	40A/30 s	econd or less
7. Fuel feed pump Pompe d'alimentation	Code No. No. de code	6837	1-51211
de carburant	Operating voltage Tension de fonctionnement	8	~ 16V
	Fuel delivery rate Taux de fourniture de carburant	30.5 in <sup>3</sup> /mir	n (500 cc/min)
	Average current Courant moyen	1.54	or less
Engine oil pressure switch	Code No. No. de code	15841-39011	
Contacteur de pression d'huile moteur	Operating pressure Pression de fonctionnement	$7.1\pm1.4$ psi (C	.5 ± 0.1 kgf/cm²)
LST charge pressure switch	Code No. No. de code	6884	1-53631
	Operating pressure ON Pression de fonctionnement ON	100 $\pm$ 21 psi (7 $\pm$ 1.5 kgf/cm²)	
	Operating pressure OFF Pression de fonctionnement OFF	100 $\pm$ 28 psi (7 $\pm$ 2.0 kgf/cm²)	
10. LST system oil temperature switch	Code No. No. de code	68841-53642	
	Operating temp. ON Température de fonctionnement ON	230±35.6°	F (110±2°C)
	Allowable temp. zone Gamme de température admissible	−22°∼248°F (	-30°C~120°C)
11. Fuel gauge unit Unité d'indicateur de	Code No. No. de code	68841-53611	
niveau de carburant	Ref. resistance F/E Résistance de référence F/E	30	/110Ω
	Allowable limit F/E Limite admissible F/E	±2s	Ω/±7Ω

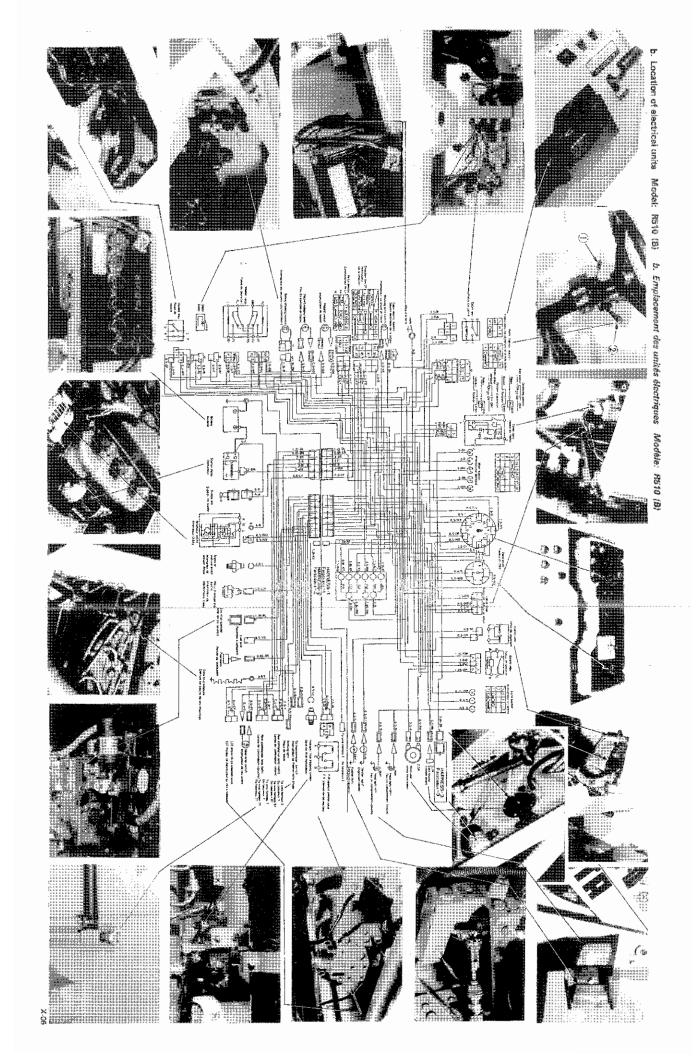
	Engine <i>Mo</i> teur	V2203-DI-BDW	V2203-BDW
2. Glow plug lamp timer Temporisateur de témoin	Code No. No. de code	15694-6	5991
de bougie incandescente	Light off time Durée d'extinction de témoin	5.0±1 se	econd
3. Engine key stop solenoid (ESS)	Code No. No. de code	15471-6	0011
Solénoïde d'arrêt de clé de moteur (KSS)	Rated current Courant nominal	13A or les	s/12V
	Plunger stroke Course de plongeur	0.35 ± 0.02 in (9	) ± 0.5 mm)
4. Engine stop timer relay Relais de temporisateur	Code No. No. de code	31351-3	1412
d'arrêt du moteur	Rated loading current  Courant de charge nominal	15A	
	Delay time Durée de délai	10±3.5 se	econds
5. Flasher unit Unité de clignotement	Code No. No. de code	38430-3	
	Light ON-OFF time  Durée ON-OFF de témoin	60 ~ 120 turns/min.	
	Current Courant	12V 23W, 1.80±0.14A	
	Winker lamp Clignotant	12V 15W (Code No.38450-34201)	
6. Light switch  Commutateur	Code No. No. de code	69201-5	3161
d'éclairage	Max. loading current  Courant de charge max.	5A/1	2V
7. Head light Phare	Code No. No. de code	68551-5	3131
	Light tube Tube de phare	12V 4	5W
8. Horn Avertisseur	Code No. No. de code	68171-5	3131
	Loading current Courant de charge	12V 2.5A	or less
9. Back buzzar Buzzer de recul	Code No. No. de code	55611-4	2101
	Loading current Courant de charge	0.24	4
	Buzzar intermittent Buzzer intermittent	50 ∼ 80 tui	rns/min

·		Engine <i>Moteur</i>	V2203-DI-BDW	V2203-BDW
20.	Fusible link Fusible principal	Code No. No. de code	38430-	34530
		dia. <i>dia</i> .		
		current courant		
	and the second s	Connector type Type de connecteur		
	Fuse box. <i>Boîte à fusibles</i>	10A	4 pcs Code No.	36370-7555-0
		15A	2 pcs Code No.	35820-7556-0
22.	Parking switch (Safety) Commutateur	Code No. No. de code	51601-3	755-0
	stationnement (sécurité)		Push: Cond Free:Not co Stroke: 0.31	
	#		Poussé : Co	ntact s de contact
23.	Relay 2 Relai 2	Code No. No. de code	36919-7503-0	
	Melal 2		Coll-Coil : A Com-NC : 0 Com-No : ∞	pprox. 60 Ω Ω
			Bobine-app Com-NC: 6 Com-NO: ∞	roximativement 60 $\Omega$
23.	Hi-Lo switch lamp	Code No. No. de code	56713-9	610-0
	Témoin commutateur Hi-Lo			
24.	Stop switch  Commutateur arrêt	Code No. No. de code	55611-4	183-0
	Commutateur arret		Push: Not of Free: cond Stroke: 0.3	
	4		Poussé : Pa Libre : con Couurse : &	

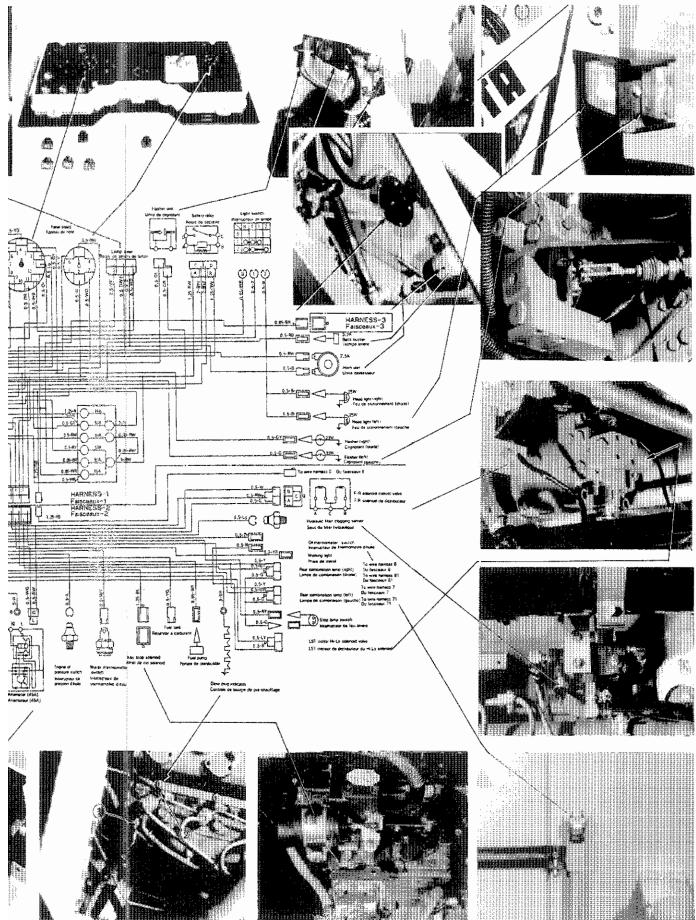


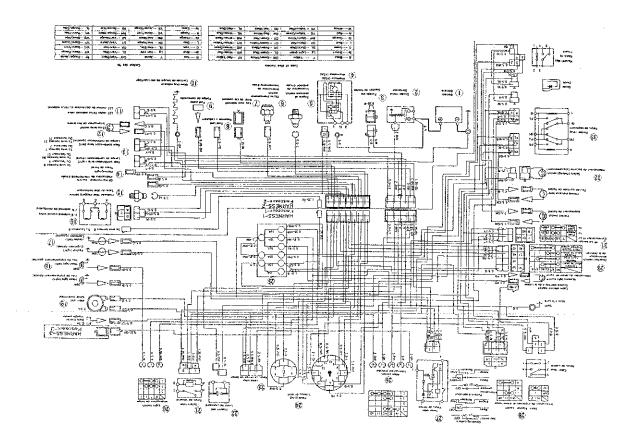
### [Fuse box wiring]

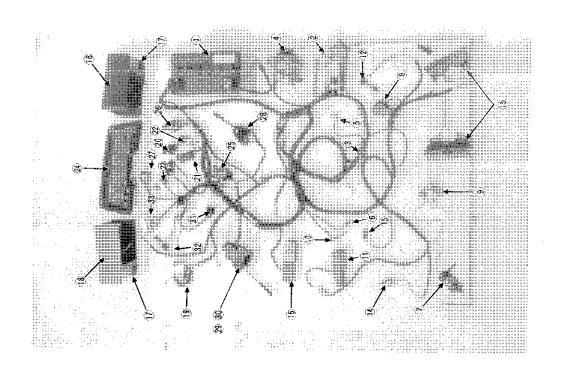
Terminal Fiche	Connection Connexion		
1	Main switch 30 Commutateur principal 30		
2	Main switch AC Safety relay, Timer relay		
3 Commutateur principal CA Relai de sécurité, relai de minuterie			
4	Timer relay (Engine key stop) Relal de minuterie (arrêt contact moteur)		
5	Hazard relay, Flasher unit Relai de danger, unité clignotant		
6	Panel board ②, Alternator F.R solenoid control valve Tableau de bord 2, alternateur Electrovanne de commande AV.AR		
7	Direction switch, stop (amp switch Working lamp switch, Flasher switch) Commutateur de direction, commutateur de témoin arrêt Commutateur de témoin marche, commutateur clignotant		
8	Fuel pump, Hi-Lo switch Pompe carburant, commutateur Hi-Lo		
9	Light switch, winieer relay, Hazard relay Commutateur éclairage, relai éclair, relai danger		



b. Location of electrical units Model: R510 (B) b. Emplacement des unités électriques Modèle: R510 (B)

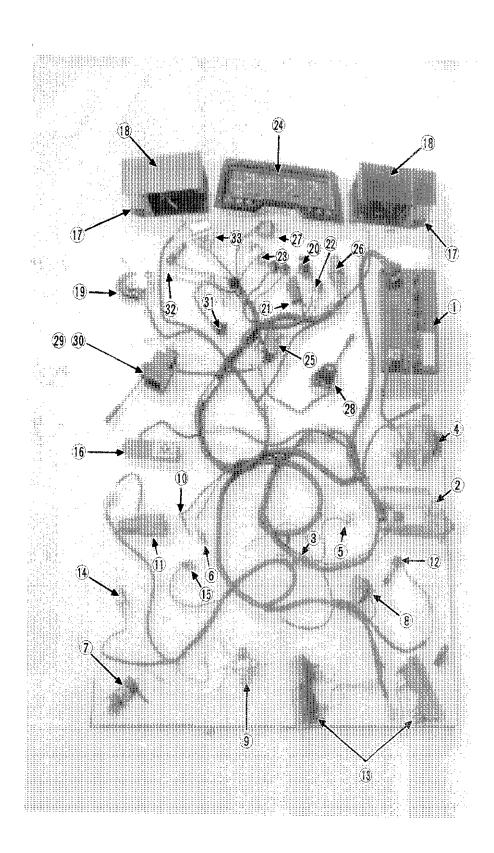


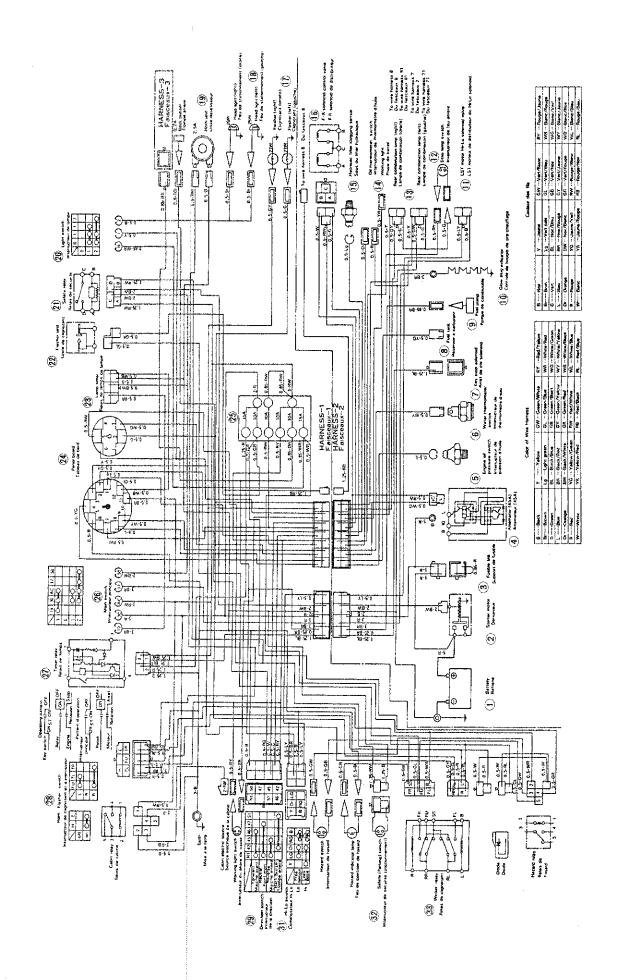


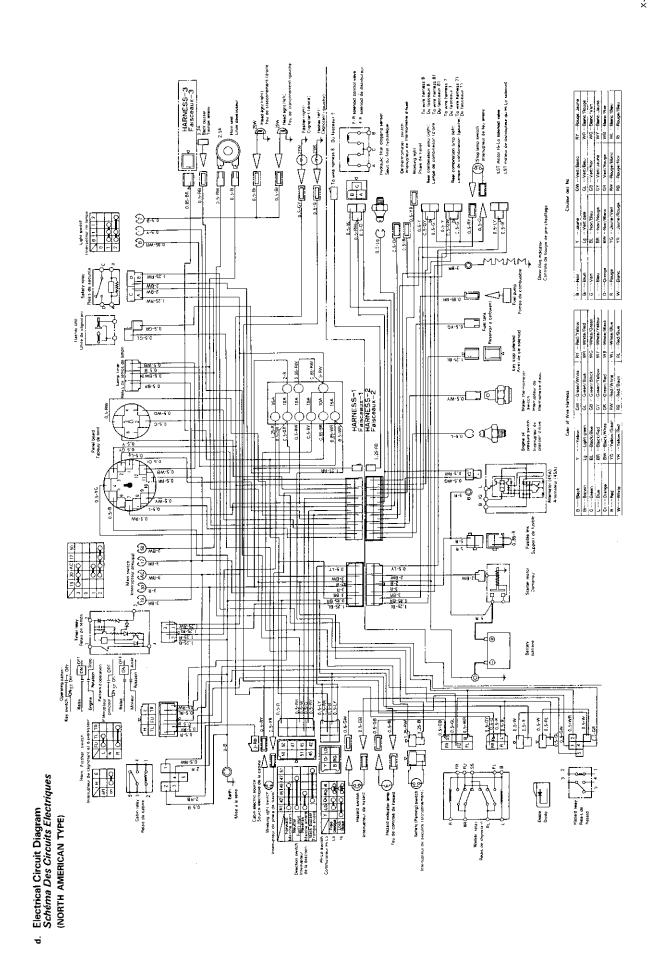


# C. Comparison of electrical wiring Model: R510 (B)

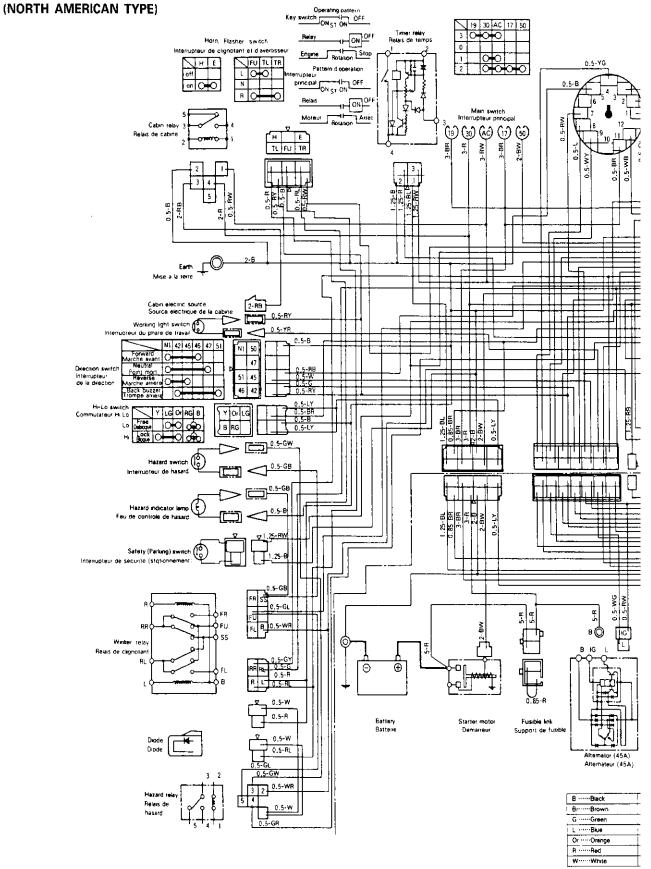
Comparaison des câblages électriques Modèle: R510 (B)

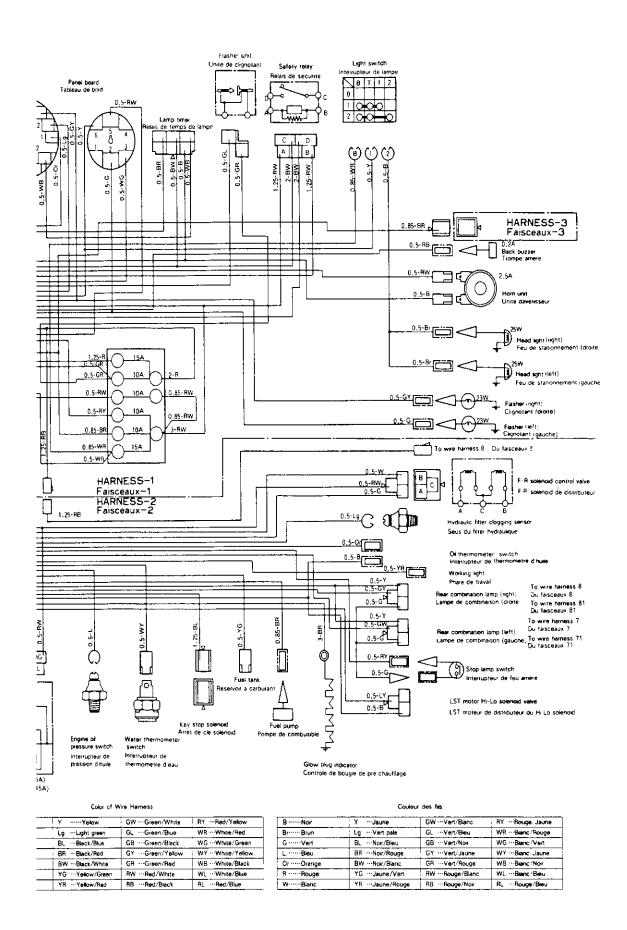


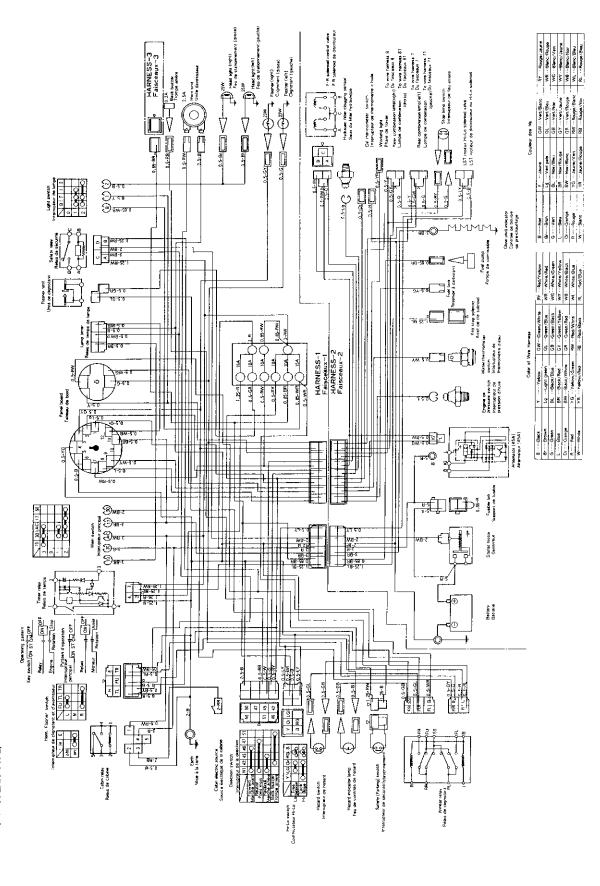




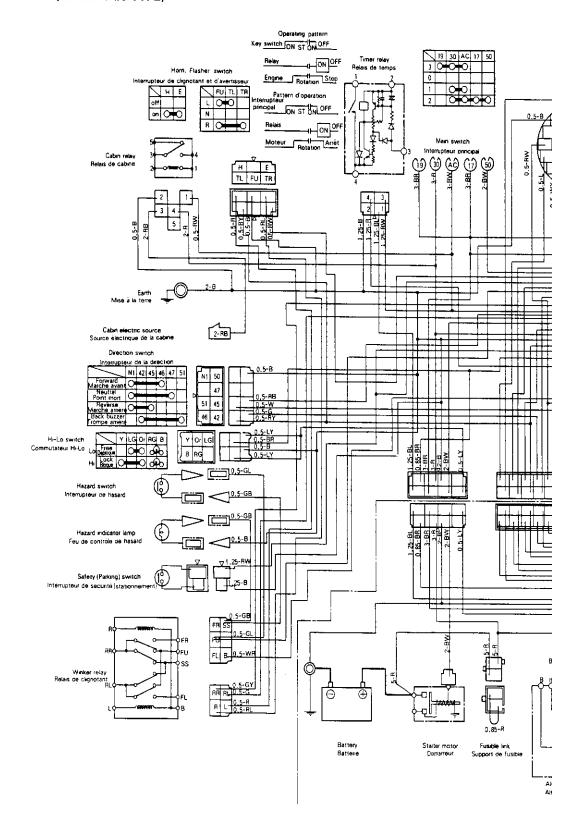
# d. Electrical Circuit Diagram Schéma Des Circuits Electriques

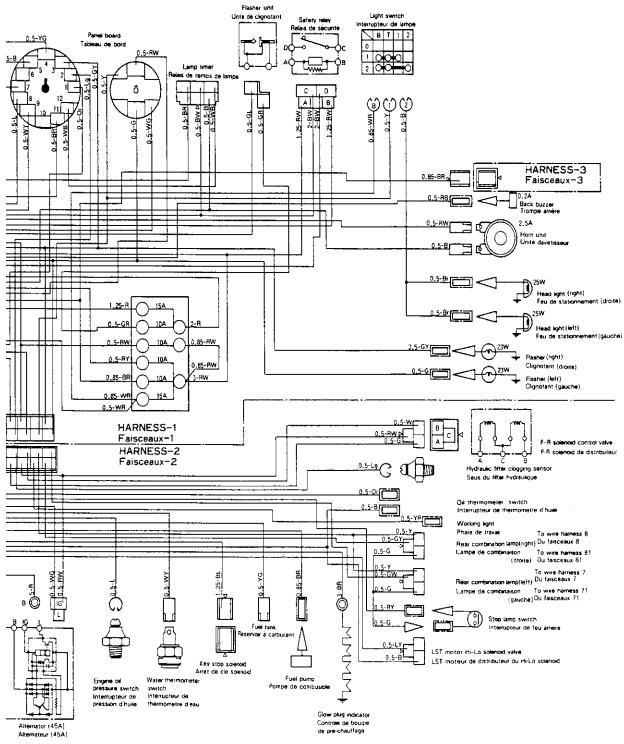






#### **CIRCUIT DIAGRAM (EUROPEAN TYPE)**



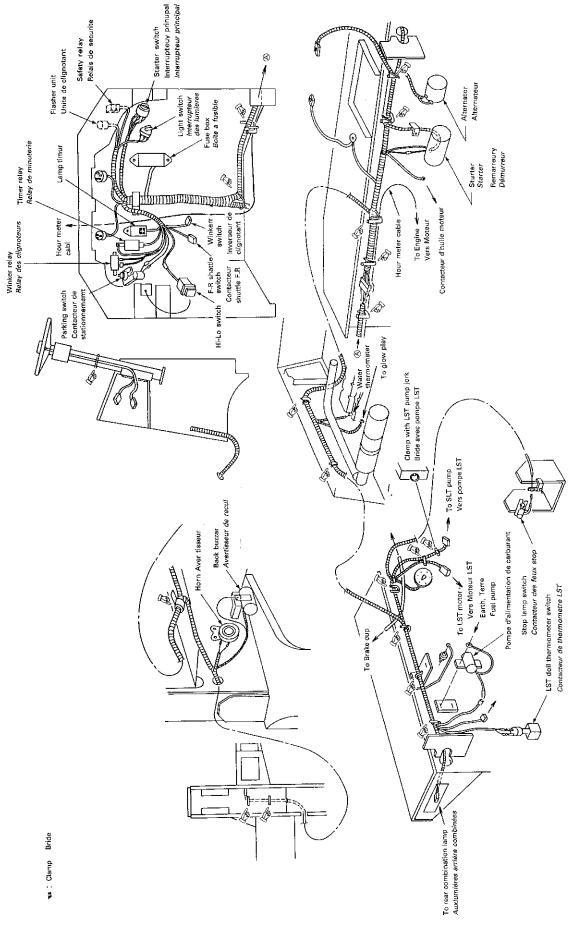


Color of Wire Hamess

Couleur des fils

8 ······Black	Y ·····Yallow	GW Green/White	RY ···Red/Yellow
Br······Brown	Lg Light green	GL Green/Blue	WR White/Rad
G ······Green	BLBlack/Blue	GB ···Green/Black	WG ··· White/Green
L ······Blue	BRBlack/Red	GYGreen/Yellow	WY White/Yellow
Or ·····Orange	BW Black/White:	GR ···Green/Red	W8 White/Black
Ř ······Red	YG ···Yellow/Green	RWRed/White	WLWhite/Blue
W······White	YR ···Yellow/Red	RB ···Red/Black	RL ···Red/Blue

B ······Now	Y ···Jaune	GW Vert/Blanc	RYRouge/Jaune
Br·····Brun	Lg ···Vert pale	GL ···Vert/Bleu	WR Blanc/Rouge
G ·····Vert	BL ···Nov/Bleu	GB ···Vert/Noir	WG Blanc/Vert
L ······Blev	BR ···Nov/Rauge	GY ···Vert/Jaune	WY ···Blanc/Jaune
Or ·····Orange	BW Nor/Blanc	GR ···Vert/Rouge	WB ···Blanc/Noir
R ·····Rouge	YG ···Jaune/Veri	RWRouge/Blanc	WLBlanc/Blau
W······Blanc	YRJaune/Rouge	RB ···Rouge/Nor	RLRouge/Bleu

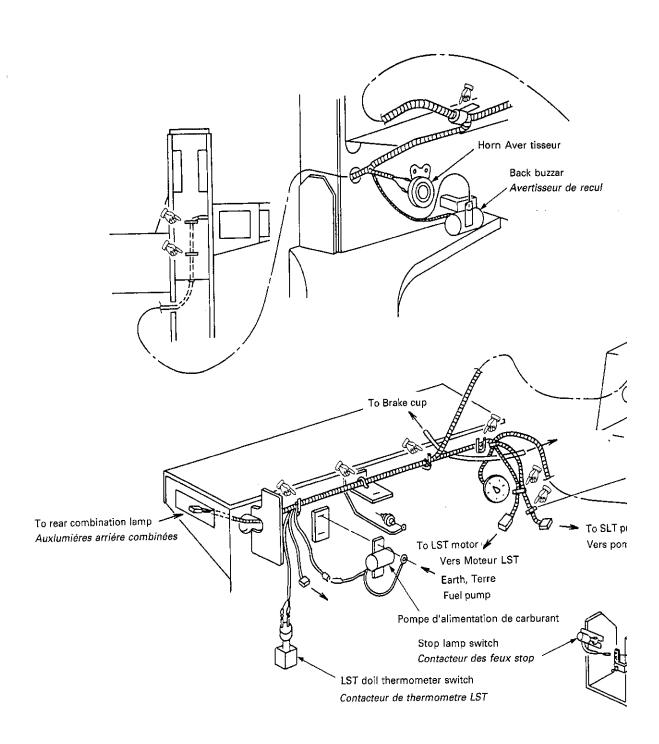


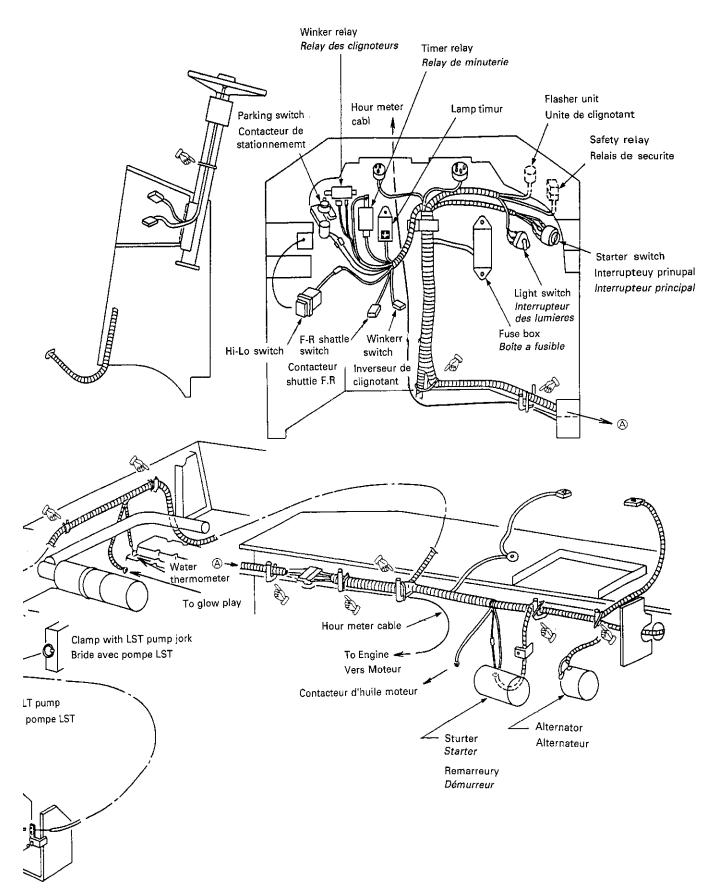
e. Wire harness clamp location R510 (B)

e. Emplacement de bride de faisceau de fils R510 (B)

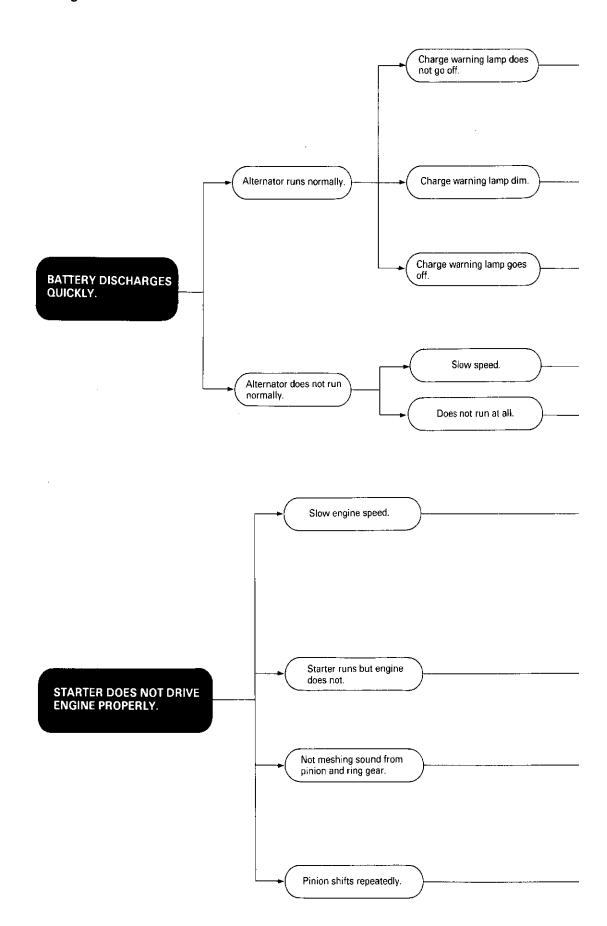
- e. Wire harness clamp location R510 (B)
- e. Emplacement de bride de faisceau de fils R510 (B)

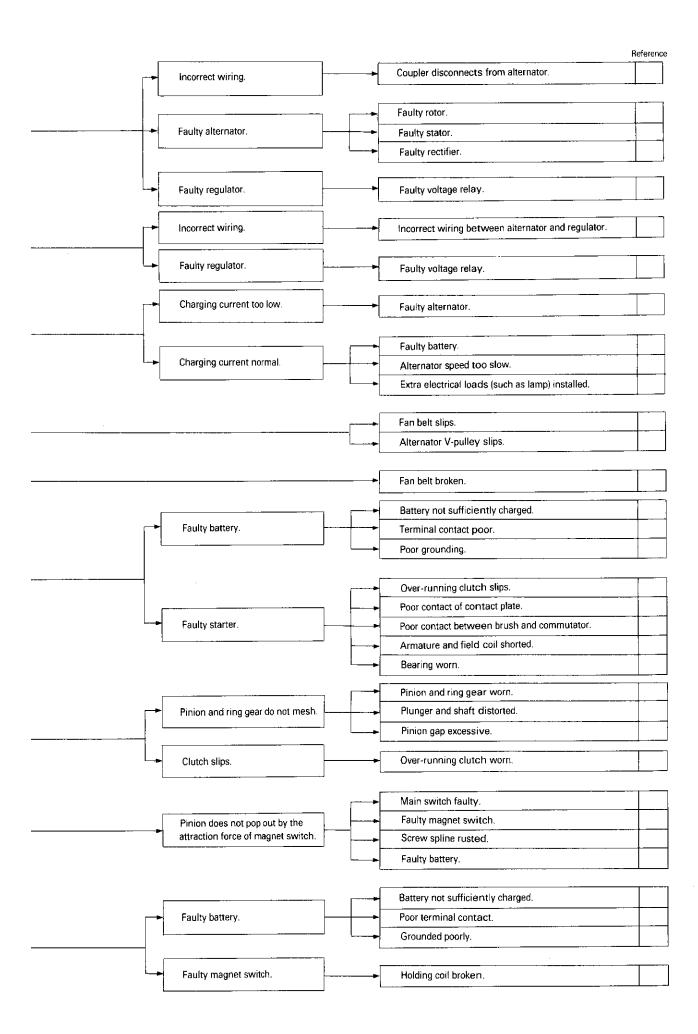
sea : Clamp Bride





## B. Troubleshooting





# Optional units & Attachments

		CONTENTS
[1]	Lis	et of optional units & attachmentsXI-01
<b>[2</b> ]	Bu	cket auto-levellerXI-02
	A.	Specification
	В.	Troubleshooting
	C.	Testing
	D.	Servicing
[3]	Lir	nited Slip DifferentialXI-08
	A.	Specification
	В.	Troubleshooting
	C.	Testing
	n	Servicina

# [1] Optional units & attachment list

Division	ltem	Part No.	Specification	Use	ļ	plicable mo R410 R410B		Sketch
		90224-1110-0	Width 1345mm, 53.0"	To protect bucket blade and to level the ground	8			
	Cutting edge assembly	90214-1110-0	Width 1580mm, 62.3"			•		
		90244-1110-2	Width 1810mm, 71.3"				•	
	Bucket tooth assembly	68131-6690-2	1-piece set	For operation requiring bucket digging	•	•		
	High life arm canombly	90224-2110-0	Dumping clearance 2010mm, 79.1"	For dumping into a 4 ton truck	•			
	High-lift arm assembly	90234-2110-0	Dumping clearance 2310mm, 90.9"	For dumping into a 8 ton truck		69		THE STATE OF THE S
		90244-2110-0	Dumping clearance 2720mm, 107.1"	For dumping into a 11 ton truck			•	# VII
	Bucket 0.35	90224-4110-0	Capacity 0.35m3, 0.46yd3 Width 1345mm, 53.0"	For loading lightweight material	9			A B
	Bucket 0.40 (Coupler type)	90215-5110-0	Capacity 0.4m³, 0.52yd³ Width 1580mm, 62.2''	Standard one-touch type bucket.		•		Y
	Bucket 0.5 (Direct)	90214-4110-0	Capacity 0.5m³, 0.65yd³ Width 1580mm, 62.2′′	For loading lightweight material		•		
Buckets	Bucket assembly: 0.60	90244-4110-0	Capacity 0.6m3, 0.78yd3 Width 1690mm, 66.5"	For loading lighweight material.				
~	Bucket 0.40 (Coupler type)	90215-5110-0	Capacity 0.4m³, 0.52yd³ Width 1580mm, 62.2"	Standard one-touch type bucket.		•		
Blades	Bucket 0.50 (Coupler type)	90245-3110-0	Capacity 0.5m³, 0.65yd³ Width 1690mm, 66.5"	Standard one-touch type bucket.			•	The state of the s
	Bucket 0.60 (Coupler type)	90245-4110-0	Capacity 0.6m3, 0.78yd3 Width 1690mm, 66.5"	Standard one-touch type bucket for lightweight material.			6	0.00
	Spade nose bucket assembly (Coupler type)	90215-2110-0	Capacity 0.36m3, 0.47yd3 Width 1580mm, 62.2"	Scooping and transfer- ing granular material.				
	Multi-purpose bucket assembly (4-in, 1 bucket) (Direct installation type)	90214-6110-0	Capacity 0.3m², 0.39yd³ Dumping haight—1970mm, 77.6° Bottom dumping hight 2300mm, 90.6°	Provides 4 different operations; seizing, earth pushing, shoveling and digging.		•		F
	Angling plow assembly (Manual type)	90215-3100-0	Width 1900mm, 74.8" Swing angle 30 deg. each side	For sand removing and		•		
	Angling plow assembly 2 (Hydraulic type)	90215-4100-0	Width 1900mm, 74.8" Swing angle 30 deg. each side	ground-leveling		•		
		90224-7110-0	Width 603mm, 23.7"		•			
	Multi-coupler assembly	90214-7110-0	Width 996mm, 39.2"	For easy attach- ment/replacement		•		
		90244-7110-0	Width 996mm, 39.2"				•	
		90225-8110-0	Lift height 2100mm, 82.7" Fork length 770mm, 30.3"		•			Eman.
	Pallet fork assembly	90215-8110-0	Lift height 2400mm, 94.5" Fork length 920mm, 36.2"	Simple fork work		6		A Segar
		90244-8110-0	Lift height 2920mm, 115.0" Fork length 920mm, 36.2"				•	
	Pallet fork essembly (Coupler type)	90214-8110-0	Lift height 2400mm, 94.5" Fork length 920mm, 36.2"	One-touch type for simple fork work.			•	,
711	Manure fork assembly	90225-9110-0	Width 1120mm, 44.1" Tine length 800mm, 31.5"		9			
Forks	Manure fork assembly (Coupler type)	90214-9110-0	Width 1580mm, 62.2" Tine length 800mm, 31.5"	Loading and transfer of grass, compost, etc. (For agriculture and raising stock)		•	•	
	Manure fork assembly 2 (Direct installation type)	90215-9110-0	Width 1580mm, 62.2" Tine length 800mm, 31.5"			•		
	Canopy Assembly 1.	90227-1110-0	G. Height 2400mm (R310/R310B) 94.5"	For more comfortable operation, this prevents rain and snow.	•	•		
			G. Height 2465mm (R410/R410B) 97.0"	(Be sure to check this height when transporting on regular road)				MAN
	Canopy Assembly	90247-1110-0	G. Height 2700mm 106.3"	For more comfortable operation, this prevent rain and snow.			•	

# [Factory option]

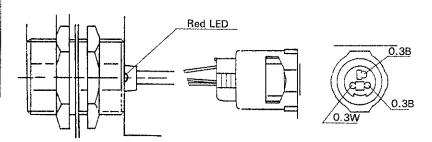
- 1. Standard canopy
- Rops/Fops canopy
   Rops cab
- 4. Heater
- 5. Front hydraulic PTO
- 6. Rear hydraulic PTO
- 7. Limited slip differential
- 8. Automatic bucket leveller

# [2] Bucket auto-leveller

# A. Specification

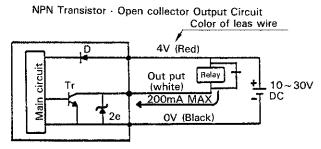
- 1. Parts specification
  - ① Proximity switch; Type GX-30M, C/N 68831-53531

Source voltage	DC10~30V
Function	ON when approaching
Current	<15mA
Max. Frequency	100Hz
Signal	Red LED lights on
Detecting distance	10mm ± 10%



② Relay comp.: C/N 68881-53541; Type: CA1a-DC12V-N

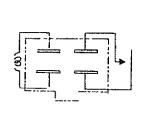
Coil resistance	$80\Omega \pm 10\%$ at $20^{\circ}$ C
Rated current	150mA ± 10% at 20°C

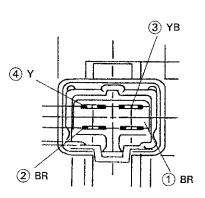


Internal circuit - Relay connection side

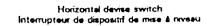
3 Solenoid control valve; Type: KVS65-MD C/N: 68881-61541

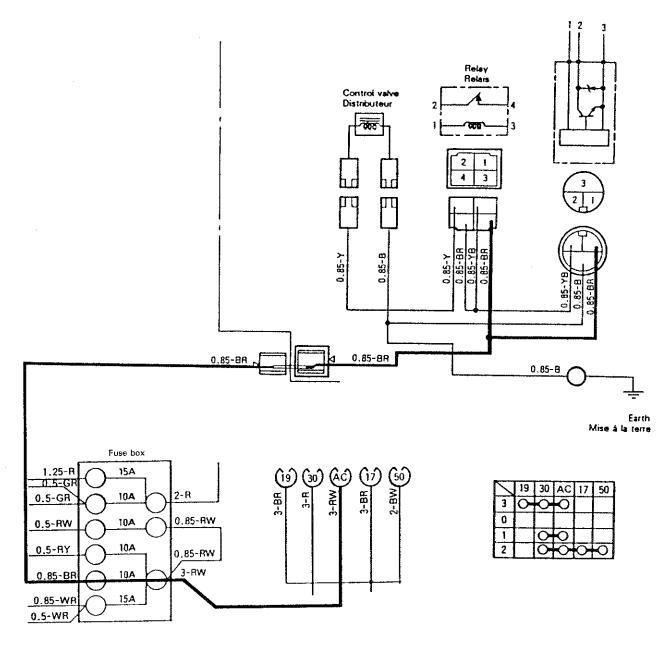
Coil resistance	37.5Ω at 5°C
Function	
Magnet force	
Spring force	
Lock nut tighten- ing forgue	





HARNESS-3





# C. Testing of electric circuit

1. Solenoid valve coil resistance Approx:  $40\Omega$  at  $20^{\circ}C$ 



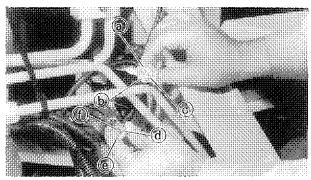
2. Coupler terminals

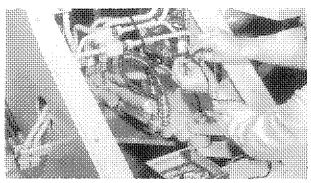
(a) White ←→ (d) Yellow-black

(b) Red ←→ (e) Red-black

(c) Black ←→ (f) Black

3. Battery voltage: (b) Red --- (c) Black





4. Solenoid valve terminal voltage

When sensor switch functions:

Approx. 12.5V (AC position)

Approx. 14.2V (Idling)

When sensor switch is off: 0V

The small LED lamp lights up when proximity sensor is on.

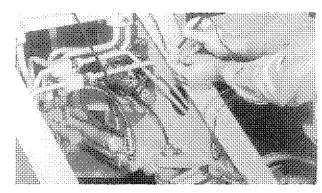
 Proximity sensor's continuity
 Separate the terminal coupler and test sensor side terminal.

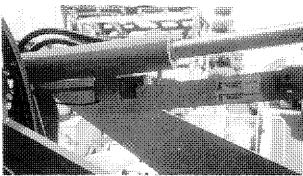
Insert tester's red probe into coupler's red terminal and black probe into black terminal.

Approx.  $28.6M\Omega$ 

Sensor on or off doesn't affect.

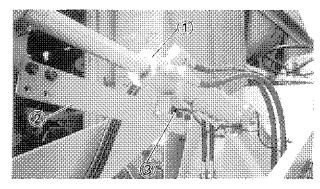
6. Proximity sensor is ON-condition.

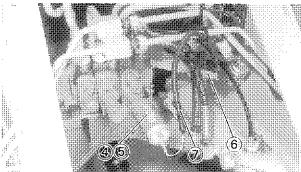




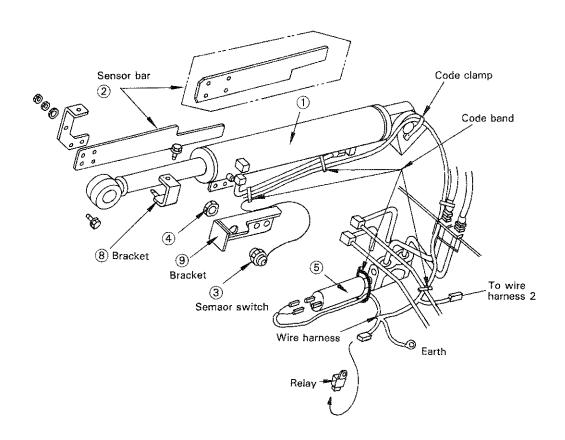
# D. Servicing

- Installation of sensor switch and solenoid valve
  - 1 Tilt cylinder
  - ② Sensor bar
  - 3 Sensor switch
  - 4 Nut Tightening torque
  - 5 Solenoid valve
  - 6 Relay (68881-5354-0)
  - ① Wire harness 3 (68881-5347-0)

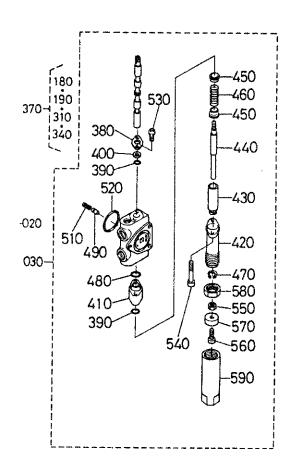




- 8 Bracket
- 9 Bracket
- 10 Code clamp
- 11) Code band
- 12) To wire harness 2
- (13) Earth



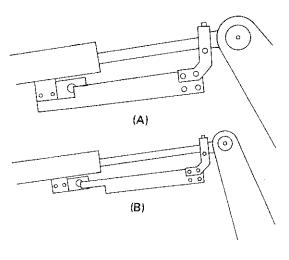
030       ASSY SECTION SPOOL       1         370       PLATE, SEAL       1         390       SEAL       2         400       WIPER       1         410       SPACER       1         420       CAP       1         430       SLEEVE       1         440       PIN       1         450       SEAT, SPRING       2         460       SPRING       1         470       RING, SNAP       1         480       O RING       1         490       POPPET       1         500       BLANK       —         510       SPRING       1         520       O RING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1         590       ASSY COIL       1			
390 SEAL 2 400 WIPER 1 410 SPACER 1 420 CAP 1 430 SLEEVE 1 440 PIN 1 450 SEAT, SPRING 2 460 SPRING 1 470 RING, SNAP 1 480 O RING 1 490 POPPET 1 500 BLANK — 510 SPRING 1 520 O RING 1 530 SCREW, WITH WASHER 2 540 BOLT 2 550 NUT 1 570 PLATE 1 580 NUT 1	030	ASSY SECTION SPOOL	1
400       WIPER       1         410       SPACER       1         420       CAP       1         430       SLEEVE       1         440       PIN       1         450       SEAT, SPRING       2         460       SPRING       1         470       RING, SNAP       1         480       O RING       1         490       POPPET       1         500       BLANK       -         510       SPRING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1	370	PLATE, SEAL	1
410       SPACER       1         420       CAP       1         430       SLEEVE       1         440       PIN       1         450       SEAT, SPRING       2         460       SPRING       1         470       RING, SNAP       1         480       O RING       1         490       POPPET       1         500       BLANK       —         510       SPRING       1         520       O RING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         570       PLATE       1         580       NUT       1	390	SEAL	2
420 CAP       1         430 SLEEVE       1         440 PIN       1         450 SEAT, SPRING       2         460 SPRING       1         470 RING, SNAP       1         480 O RING       1         490 POPPET       1         500 BLANK       —         510 SPRING       1         520 O RING       1         530 SCREW, WITH WASHER       2         540 BOLT       2         550 NUT       1         570 PLATE       1         580 NUT       1	400	WIPER	1
430       SLEEVE       1         440       PIN       1         450       SEAT, SPRING       2         460       SPRING       1         470       RING, SNAP       1         480       O RING       1         490       POPPET       1         500       BLANK       -         510       SPRING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1	410	SPACER	1
440       PIN       1         450       SEAT, SPRING       2         460       SPRING       1         470       RING, SNAP       1         480       O RING       1         490       POPPET       1         500       BLANK       —         510       SPRING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         570       PLATE       1         580       NUT       1	420	CAP	1
450       SEAT, SPRING       2         460       SPRING       1         470       RING, SNAP       1         480       O RING       1         490       POPPET       1         500       BLANK       -         510       SPRING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1	430	SLEEVE	1
460       SPRING       1         470       RING, SNAP       1         480       O RING       1         490       POPPET       1         500       BLANK       —         510       SPRING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1	440	PIN	1
470 RING, SNAP 1 480 O RING 1 490 POPPET 1 500 BLANK - 510 SPRING 1 520 O RING 1 530 SCREW, WITH WASHER 2 540 BOLT 2 550 NUT 1 570 PLATE 1 580 NUT 1	450	SEAT, SPRING	2
480       O RING       1         490       POPPET       1         500       BLANK       —         510       SPRING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1	460	SPRING	1
490       POPPET       1         500       BLANK       —         510       SPRING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1	470	RING, SNAP	1
500       BLANK       —         510       SPRING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1	480	O RING	1
510       SPRING       1         520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1	490	POPPET	1
520       O RING       1         530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1	500	BLANK	
530       SCREW, WITH WASHER       2         540       BOLT       2         550       NUT       1         560       BOLT       1         570       PLATE       1         580       NUT       1	510	SPRING	1
540     BOLT     2       550     NUT     1       560     BOLT     1       570     PLATE     1       580     NUT     1	520	O RING	1
550         NUT         1           560         BOLT         1           570         PLATE         1           580         NUT         1	530	SCREW, WITH WASHER	2
560         BOLT         1           570         PLATE         1           580         NUT         1	540	BOLT	2
570 PLATE 1 580 NUT 1	550	NUT	1
580 NUT 1	560	BOLT	1
	570	PLATE	1
590 ASSY COIL 1	580	NUT	1
	590	ASSY COIL	1

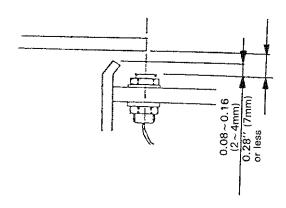


- 2. Installation of sensor bar differs between STD bucket and pallet fork.
  - (A) STD Bucket
  - (B) Pallet fork

Installation of sensor switch

- 2 Sensor bar
- 3 Sensor switch
- 9 Bracket





# [3] Limited Slip Differential (LSD)

### A. Specification

1. LSD clutch capacity; Tc

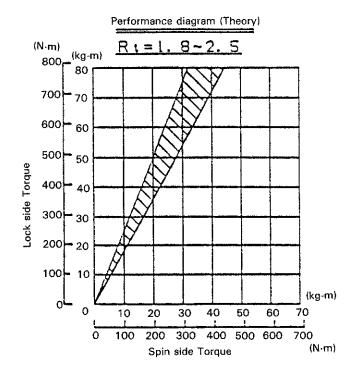
Tc=

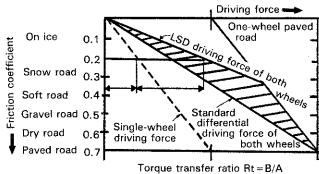
- 2. Clutch coefficient; K
- 3. Torque transfer ratio; Rt

#### < Comparison of torque transfer ratio >

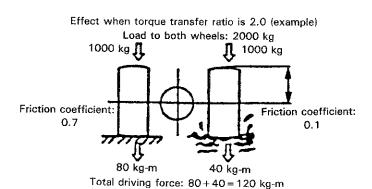
	Standard differential	Kubota LSD	Kawasaki TPD	Komatsu TPD
Torque transfer ratio Rt (ratio between right and left wheels	1.0	1.90	1.83	1.36
Drive transfer torque (both wheels)	1.0	1.45	1.41	1.18

Comparison of Driving Force
 Chart indicating drive force difference





- ① Differential resistance is generated at the multi-plate clutch friction mechanism using thrust force generated at the cam mechanism attached to the gear shaft to prevent slippage of tires.
- ② More driving torque is supplied to the wheel with better traction condition when the other wheel is on a poor traction condition road in order to increase the total driving force as shown.



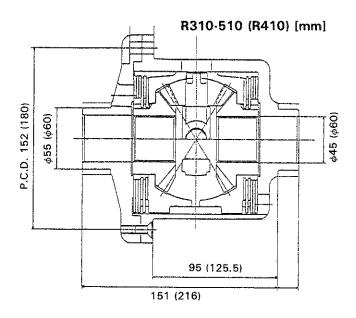
#### 5. Installation

 It is generally recommended to install the LST unit in the front differential case for optimum performance.

#### 6. Lubrication

Change of differential oil: when the LSD is installed, differential oil of all wheel loader models is changed from engine oil D 10W-30 to gear oil M80B.

Reason: When engine oil is used to the LSD differential, paki-paki sounds are generated from differential gears during turning, especially when the steering wheel is maintained at a turned position. This occurs due to wrong combination of LSD clutch plate and oil, causing change in the friction characteristics, which has no adverse effects including durability.



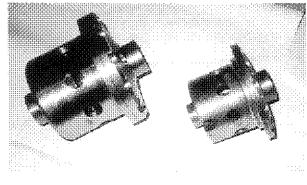
#### Specified differential oil type

At factory	мвов					
Oil replacement at field	Shell	Mobil	TIP .	Chevron	TEXACO	
	Shell Donax TD	Mobiland Super Universal	Multi-purpose Thuban EP SAE80W	Chevron Universal Gear Lubricant SAE80W-90	Multigear Lubricant EP SAE 80W-90	

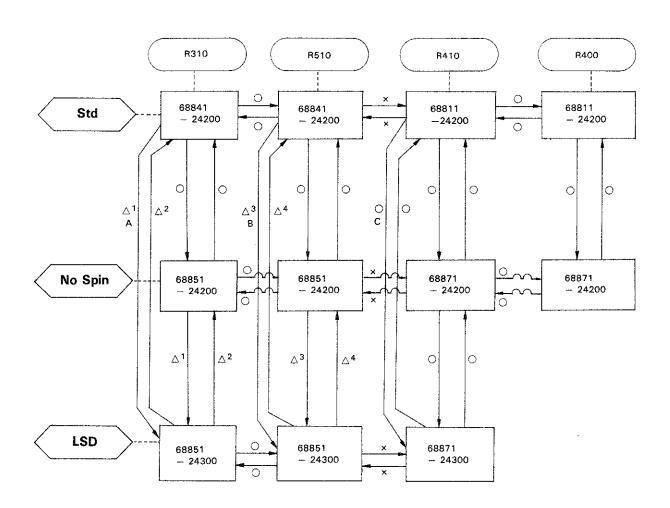
# 7. Interchangeability of differentials (Standard type—Non Spin type—LSD)

Interchangeability between differential types is shown below.

- If a change is routed only paths indicated as (), the two types are interchangeable.
- If a change is routed paths indicated as ○
   and △, the two types are interchangeable
   provided the required parts are used.
- If a change is routed a path indicated as X, the two types are not interchangeable.



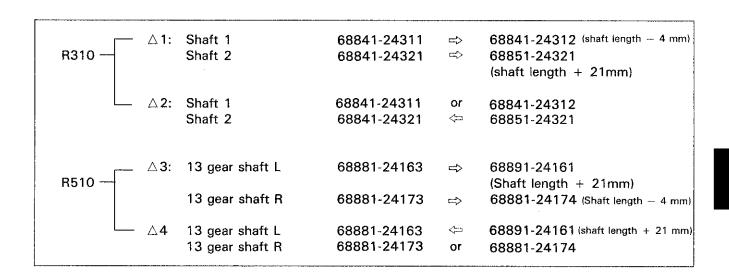
(R410) (R310-R510)



Note: Above interchangeable relationship indicates technical possibility only.

Actual replacement requires differential, relating part (shaft, gear shaft) and others (packin, shim, bearing etc).

Kit No. will be adapted for A, B and C in near future.



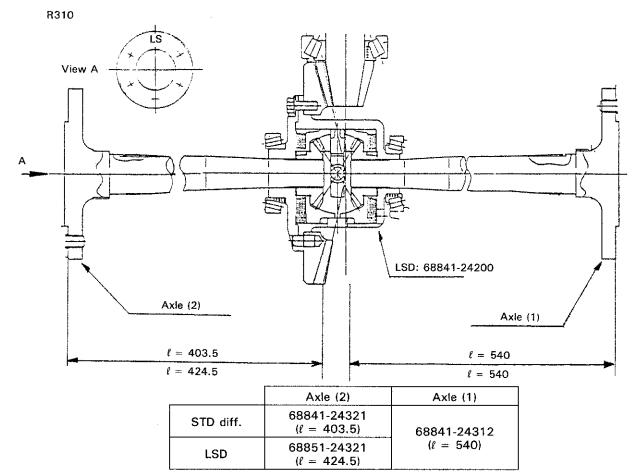
Note: Further, the following types of steering cylinders are required when changing from the standard differential to the nospin and LSD type differential.

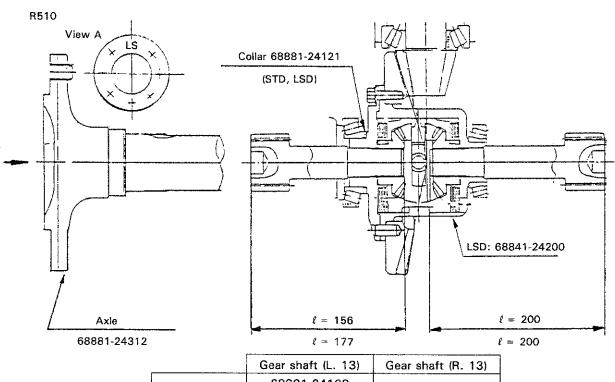
#### (Steering cylinder code No)

Model	For STD	Differential	No Spin or LSD	
Iviodei	Code No.	Cylinder size	Code No.	Cylinder size
R310	68841-34811	1.97×0.98×8.86 (50×25×225)	<del></del>	<b>←</b>
R510	68881-34811	2.76×1.38×10 (70×35×254)	68891-34811	3.15×1.57×10 (80×40×254)
R410	68861-34811	2.36×1.18×8.86 (60×30×225)	68871-34811	2.76×1.38×8.86 (70×35×225)
R400	68817-34811	2.36×1.18×8.86 (60×30×225)		

Tube I.D. × Rod O.D. × stroke

# • Differential & axle shaft





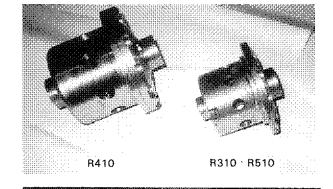
# D. Servicing (Disassembling & reassembling)

(Dismantling and reinstalling of LSD assy is same procedure of STD differential assy.)

LSD assy code No.

68851-24301: R310 R510

68871-24301: R410



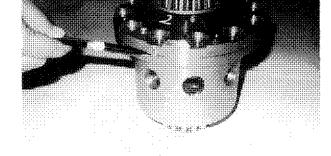
# 1. Disassembling

1) Before disassembly, put the alignment mark on both cases.

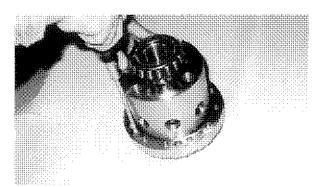
Remove 8 pieces of screw evenly and separate it.

Screw size: M6×12 (R310 R510)

M8×16 (R410)

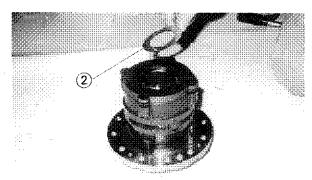


- 2) Take out diff. lock assy from case.
  - 1 Diff. Case A
  - 2 Thrust washer

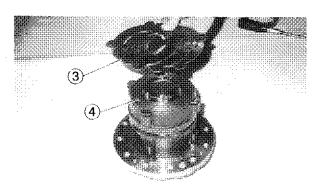


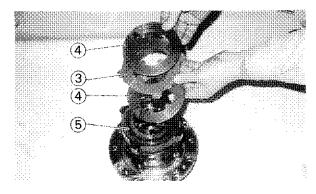
3) Take out thrust washer ②.

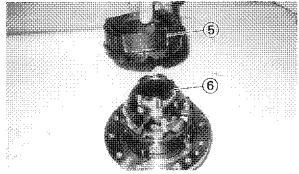
Thrust washer ② may remain in diff. case
A.

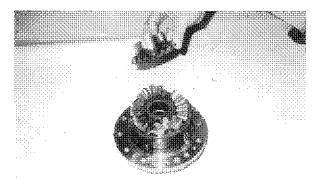


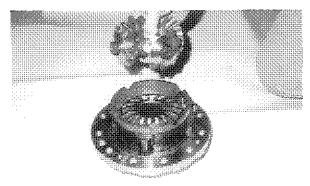
- 4) Take out three friction plates.
  - (3) Friction plates.
  - (4) Friction disk.

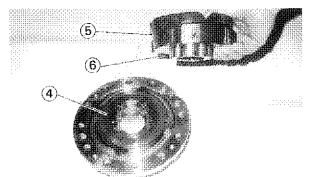












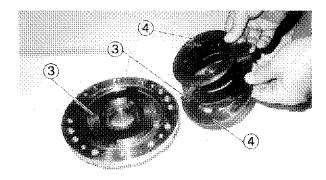
- 5) Take out two friction disks and one friction plate from pressure ring.
  - 3 Friction plate
  - 4 Friction disk
  - ⑤ Pressure ring
- 6) Take out pressure ring.
  - 5 Pressure ring
  - 6 Side gear

7) Remove side gear.

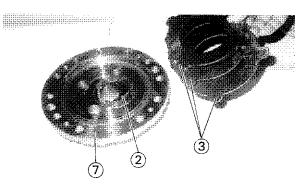
8) Remove pinion and pinion shaft.

- 9) Take out side gear with pressure ring.
  - (4) Friction disk
  - (5) Pressure ring
  - 6 Side gear

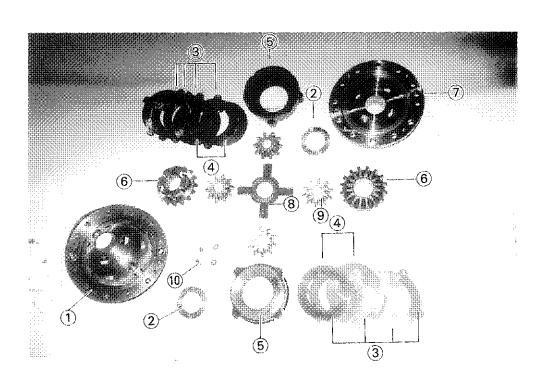
- 10) Take out two friction discs and one friction plate.
  - 3 Friction plate
  - 4 Friction disk



11) Take out three friction plates ③ and thrust washer ②.

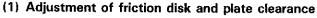


- 12) Parts indentification.
  - 1 Diff. case A
  - (2) Thrust washer
  - 3 Friction plates, 8 pcs
  - 4 Friction disks 4 pcs
  - ⑤ Pressure ring
  - 6 Side gear
  - 7 Diff. case B
  - 8 Pinion shaft
  - 9 Pinion
  - ① Screw



### 2. Adjustment and Inspection

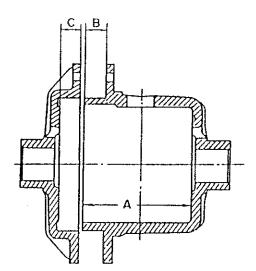
Before assembly, adjust clearance in axial direction of the clutch and side gear according to the following instructions:



 Measurement of depth of differential case (right)

Measure the dimension of a differential case from the left end face to the friction plate contact face by using a pair of calipers and let this actual measured dimension be A.

Then measure the dimensions from the same end face to the coupling face of the differential case (left) and let the actual measured dimension be B.



#### Measurement of depth of differential case (left)

Measure the dimension from the couplind face with the differential case (right) to the friction plate contact face and let the actual measured dimension be C.

in. (mm)

Model		R310·510	R410
Code No.		68851-24301	68871-24301
Standard A		3.64 (92.5)	4.93 (125.15)
В		0.14 (3.5)	0.31 (8.0)
С		0.08 (2.0)	0.30 (7.64)
	А-В	3.50 (89.0)	4.61 (117.15)

 Measurement of total lengths of pressure ring (shaft coupling), friction disk, and plate assembly.

Couple the right and left pressure rings with the pinion shaft. Put six plates, friction disk (2), friction plates (4), side by side behind each pressure ring. (Individual parts should be in dry condition.) plates on the line of V-grooved axis and let the actual dimension be D.

24) Upon measuring dimensions A, B, C, and D, make adjustment according to the following instructions:

Make adjustment so that  $\{(A - B) + C\}$ - D = 0.002~ 0.008" (0.05 to 0.2 mm.)

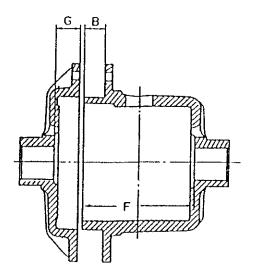
Select the plate thickness of friction disk so that the dimensional difference including the right and left clutch plates will be under 0.002" or 0.05 mm.

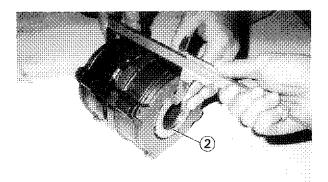
in.(mm)

Model	R310·R510	R410	
Code No.	68851-24301	68871-24301	
Standard dimen- sion D	3.58 (91.0)	4.91 (124.8)	
(A – B) + C – D	0.002~0.008 (0.05~0.2)		
Dimensional difference includ- ing the right and left clutch plates	1	002 5mm)	

in.(mm)

Parts	R310·R510		R410	
	Code No.	Thickness	Code No.	Thickness
Friction plate	68851-24391 Plate 1.75	0.068 (1.75)	68871-24391 Plate 2.4	0.09 (2.4)
	68851-24411 Plate 1.85	0.073 (1.85)	68871-24411 Plate 2.5	0.10 (2.5)
Friction disk	68851-24421	0.07 (1.75)	68871-24421	0.09 (2.4)
Thrust washer	68851-24431 standard : 1.5	0.059 (1.5)	68871-24431 standard : 1.6	0.063 (1.6)
	68851-24441 1.6	0.063 (1.6)	68871-24441 1.45	0.057 (1.45)
	68851-24451 1.7	0.067 (1.7)	68871-24451 1.75	0.069 (1.75)





(2) Adjustment of play in the direction of side gear axis (Adjustment of backlash between the pinion and the side gear)

Adjust the play in the direction of side gear axis so that the play is generated only from the backlash of the side gear and differential pinion gear (0.6 to 0.9mm for right and left combined).

 Measurement of depth of differential case (right)

Measure the dimension from the left end face of differential case to the contact face of thrust washer and let the actual measured dimension be F.

Then measure the dimension from the same end face to the coupling face of the differential case (left) and let the actual measured dimension be B.

Standard dimension:

 Measurement of depth of differential case (left)

Measure the dimension from the coupling face with the differential case (right) to the thrust washer contact face and let the actual measured dimension be G. Standard dimension:

 $G = R310 \cdot R510$ : 0.14" (3.5mm)

R410 : 0.39" (9.85mm)

3) Measurement of dimension between end thrust washers in assembled state.

In the assembly of the side gear, pinion, pinion shaft, pressure ring, and thrust washers, press the pressure ring to the pinion shaft in the direction of the axis until the clearance becomes 0. Then contact the side gear with the pinion to eliminate backlash. Measure the distance between two thrust washers and let the measured dimension be H.

Measuring condition:

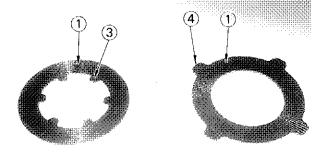
- Every part should be dry.
- Measuring compression force 1541bs (70kg)
- 4) When the dimensions are known, make adjustment as follows:

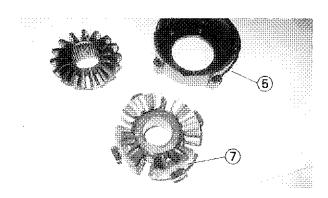
Arrange the assembly so that  $\{(F - B) + G - H\} = 0.002'' \sim 0.008'' (0.05 \sim 0.2mm)$ 

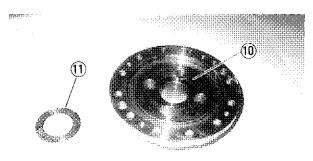
Select thrust washer so as to dimensional difference from each of the right and left pressure rings to the thrust washer will be under  $0.002'' \sim 0.005$  mm.

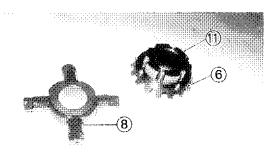
Model		R310·R410	R410
Code No.		68851-24301	68871-24301
	В	0.14 (3.5)	0.31 (8.0)
	F	3.70 (94)	5.01 (127.35)
	F-B	3.56 (90.5)	4.70 (119.35)
Photo Control of the	G	(0.14 (3.5)	0.39 (9.85)
	H	3.70 (94)	5.09 (129.2)
(F - B) + G - }	1	0.002"~0.00	8" (0.05~0.2)
Dimensional difference from each of the right and left pressure rings to the thrust washer		0.002"	(0.05mm)

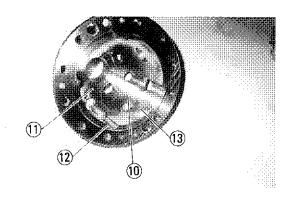
- (3) Inspection and Correction of each part.
  Clean disassembled parts in wash oil (lead-free gasoline, etc.), dry with blown air and inspect.
  - Inspection and correction of contact and sliding surfaces of components.
  - a. If dents or damages are found with the friction disk and friction plate on the friction sliding surface ①, four protrusions ③ inside the disk and/or four protrusions ④ on the outer edge, replace them with new parts since clutch pressure will be faulty.
  - b. If damages and/or flashes are found with pressure ring on the friction sliding surface
    (5) to the disk, grind the surface by using a piece of oil stone and correct the surface by sliding on a level block with compound.
  - c. If damages andor flashes are found with the thrust washer on the sliding surface (1) with the side gear or differential case, remove them by applying oil stone.
  - d. If dents or damages are found with the case on the spacer contact surface 10 and thrust washer sliding surface 11, or with the pressure ring or plate on the protrusion engagement groove 12, correct respective parts by applying oil stone to restore same smoothness as other normal sections.











e. Correct flashes and/or dents of the following parts with oil stone: gear and pressure ring sliding diameter (6), side gear and thrust washer sliding surface (1), pressure ring and pinion sliding ball diameter (7), shaft and pressure ring V-surface (8), pressure ring protrusion and case engagement surface (9), and the engagement section (13) of pressure ring outside diameter and the case inside diameter.

2) Inspection of distortion of friction plate and friction disk.

Check distortion of friction disk and friction plate by placing a plate or disk on the level block.

Contact the probe leg of a dial gauge set on the mount to the plate or disk surface and rotate the plate or disk.

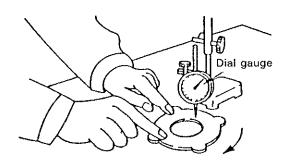
If the dial gauge reading is under 0.08 mm, the subject is in normal condition. If an excessive distortion is found, replace it with new part since it deauses clutch noise.

Distortion limit:	R310-R510: 0.003"	
inch (mm)	(0.08mm)	
	R410 : 0.004"	
	(0.1mm)	

Inspection of wear of friction plate and friction disk

Wear of friction plate and disk can be detected by measuring the thickness of protrusion on the outer edge (section making no friction sliding: Photo A) and the friction sliding surface (Photo B) by using a micrometer.

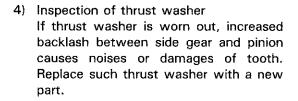
Wear limit: inch (mm)	0.004" (0.1) and under



Likewise, in the case of friction disk, wear can be detected by the difference of plate thickness between the inner protrusion A (surface making no friction sliding) and the friction sliding surface B.

Wear limit: in. (mm) 0.004 (0.1) and under

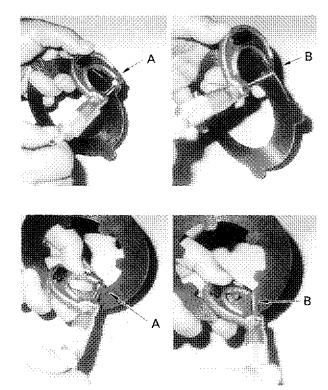
Note: If a sign of seizure is found with friction disk and friction plate or if these parts have excessive wear (0.004" or 0.1 mm and over), always replace with new parts since noises may be generated or related mechanism may be damaged.

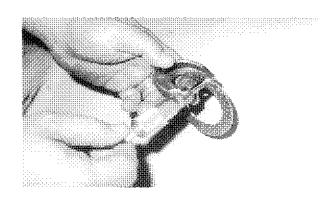


Note: Measure the plate thickness with a micrometer.

Replace washer if the thickness reading is under below.

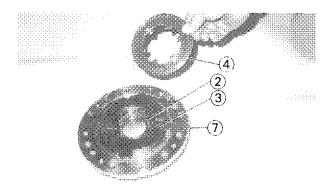
R310·R510: 0.05" (1.3 mm) R410' : 0.05" (1.25 mm)

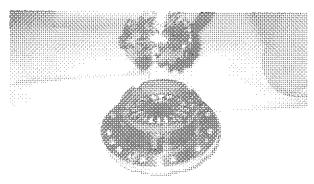


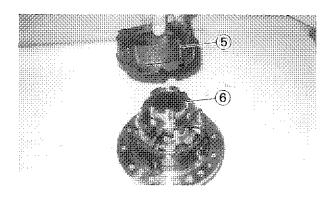


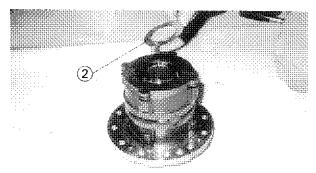
in.(mm)

Parts	R310·R510		R410	
	Code No.	Thickness	Code No.	Thickness
Friction plate	68851-24391 Plate 1.75	0.068 (1.75)	68871-24391 Plate 2.4	0.09 (2.4)
	68851-24411 Plate 1.85	0.073 (1.85)	68871-24411 Plate 2.5	0.10 (2.5)
Friction disk	68851-24421	0.07 (1.75)	68871-24421	0.09 (2.4)
Thrust washer	68851-24431 standard	0.059 (1.5)	68871-24431 standard	0.063 (1.6)
	68851-24441	0.063 (1.6)	68871-24441	0.057 (1.45)
	68851-24451	0.067 (1.7)	68871-24451	0.069 (1.75)









#### 3. Reassembly

 Apply specified differential gear oil to thrust washer and insert it to the differential case B.

Assemle thrust washer, three friction plates, one friction disk, one friction plate and one friction disk in this order onto the differential case B.

- 2 Thrust washer
- 3 Friction plate
- (4) Friction disk
- (7) Diff. case B

Note: Care must be taken since an error in assembling sequence deteriorates L.S.D. performance.

Arrange four protrusions on the pressure ring and friction plate to match, place on a round bar, and insert along four grooves on the differential case.

Note: When inserting inner parts, fully apply specified differential gear oil to pressure ring, friction disk and plate.

Insert the side gear to the pressure ring.

- Insert the pinion to the pinion shaft. Then assemble it to V-shaped groove of pressure ring assembled to the case and make four pinions and side gears engage to one another.
- 3) Assemble side gear to the pinion, then insert the pressure ring to the case.

4) Insert the clutch plate from behind the pressure ring in the order of one friction disk, one friction plate, one friction disk, and three friction plates by guiding the protrusions on the plates to engage the case grooves.

Insert the thrust washer (after fully applying specified differential gear oil) to the left side case.

 Connect differential cases. Match the match marks to match ring gear bolt hole position.

M: Match mark

6) Tighten mounting screws.

#### Note:

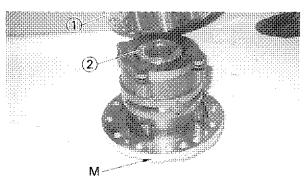
Reassembling of LSD assy in differential housing and axle assy is quite same procedure for standard differential. Refer R510B WSM (Code No.97899-60240 or 97899-60250) page III-18  $\sim$  .

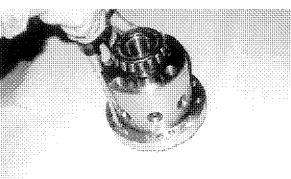
#### 4. Operational Check

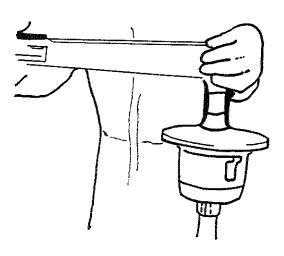
 Fix one of the side gears and turn the other side gear with a torque wrench and measure torque when the side gear starts to turn.

Note: Check that the torque reading is within 7.23 ft.lb (1 kgf.m)or wrench turns smoothly.

 Check the dislocation of spiral bevel gear's outer diameter by a dial gauge.
 Allowable dislocation: Within 0.002" (0.05mm)







#### 4. Recommended Oil

#### (1) Recommended oil

- Oil used in the factory: M80 B Gear oil (Kubota Genuine Oil)
- Interchangeable oil

Shell	Shell Ddonax TD	
Mobil	Mobil and Super Universal	
133	Multi-purpose Thuban EP SAE 80W	
Chevron	Chevron Universal Gear Lubricant SAE 80W — 90	
TEXACO	Multi-gear Lubricant EP SAE 80W — 90	

(2) Inspection, replenishment, and replacement period of differential oil

Drained differential oil from the drain plug is turbid in black compared with unused oil. Note that the turbidity is caused by the mixture of surface treatment agent (phosphate coating) on the clutch plate. Do not misunderstand it for discoloration of degraded differential oil.

- Replacement of oil for new vehible: 500hs (First time)
- 2) Inspection and replenishment: Every 500hs
- 3) Oil replacement: Every 1000hs

#### (3) Oil amount

Model	R310	R410	R510
Front differential and axle assy	0.61 usgal	1.93 usgal	2.9 usgal
	(2.3ℓ)	(7.3ℓ)	(11.0ℓ)
Rear differential and axle assy (including reduction gear case)	0.66 usgal	2.17 usgal	3.0 usgal
	(2.5/)	(8.2 <i>t</i> )	(11.3ℓ)

When replacing or refilling the oil, securely check the oil level. In the factory, gear oil M80B is supplied in LSD.